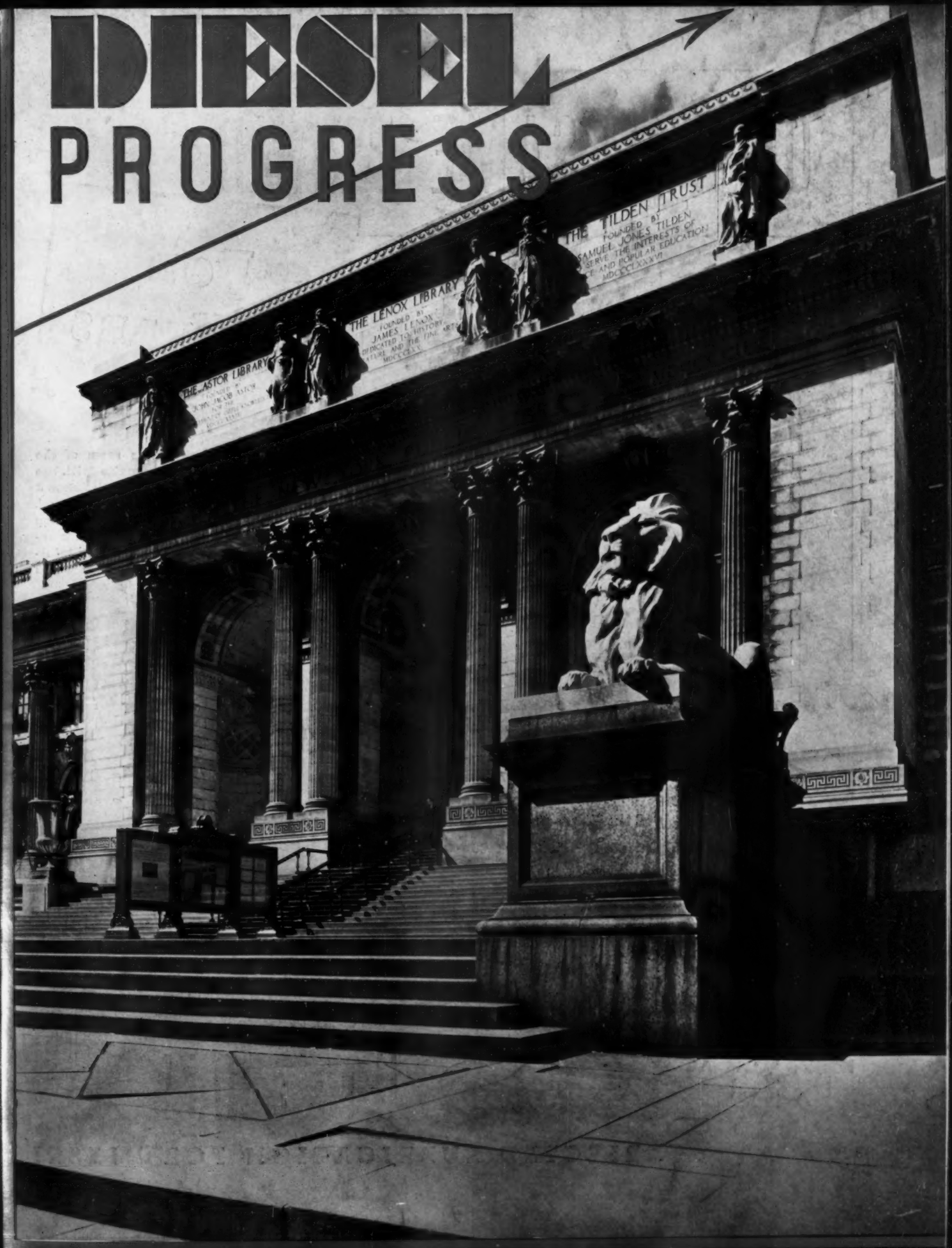
DIESEL PROGRESS



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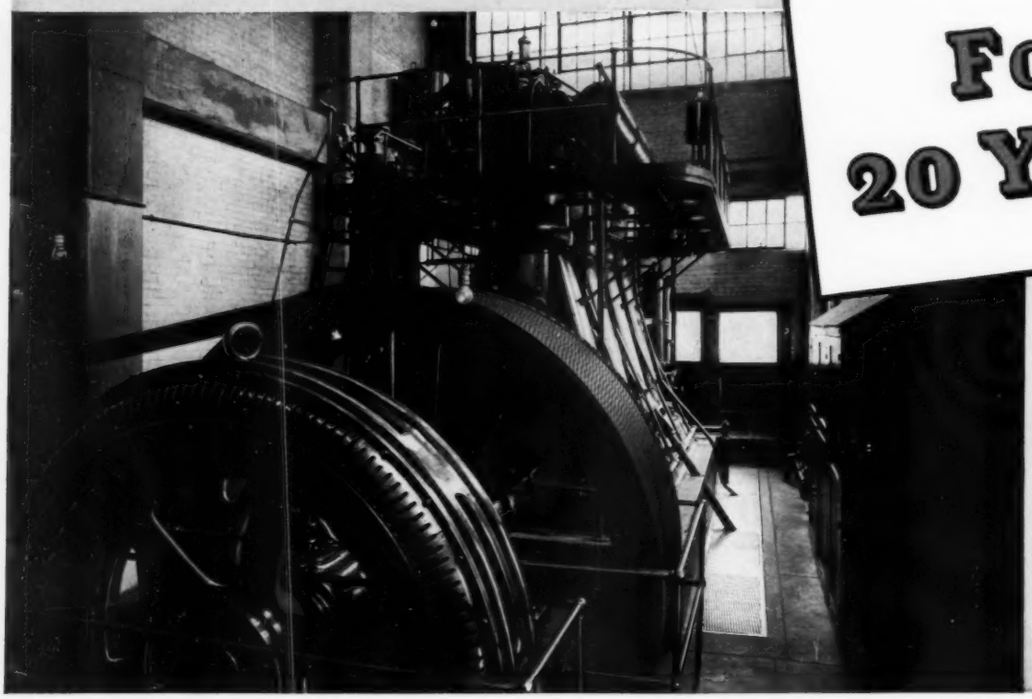

Engine room of the Chickasha Mill. The engine is a McIntosh & Seymour 500 h.p. Diesel. Since set up more than 20 years ago, this engine has been lubricated with Texaco Ursa Oil exclusively.

IT'S A McINTOSH AND SEYMOUR DIESEL, 500 h.p., furnishing power for a flour mill in Chickasha, Oklahoma.

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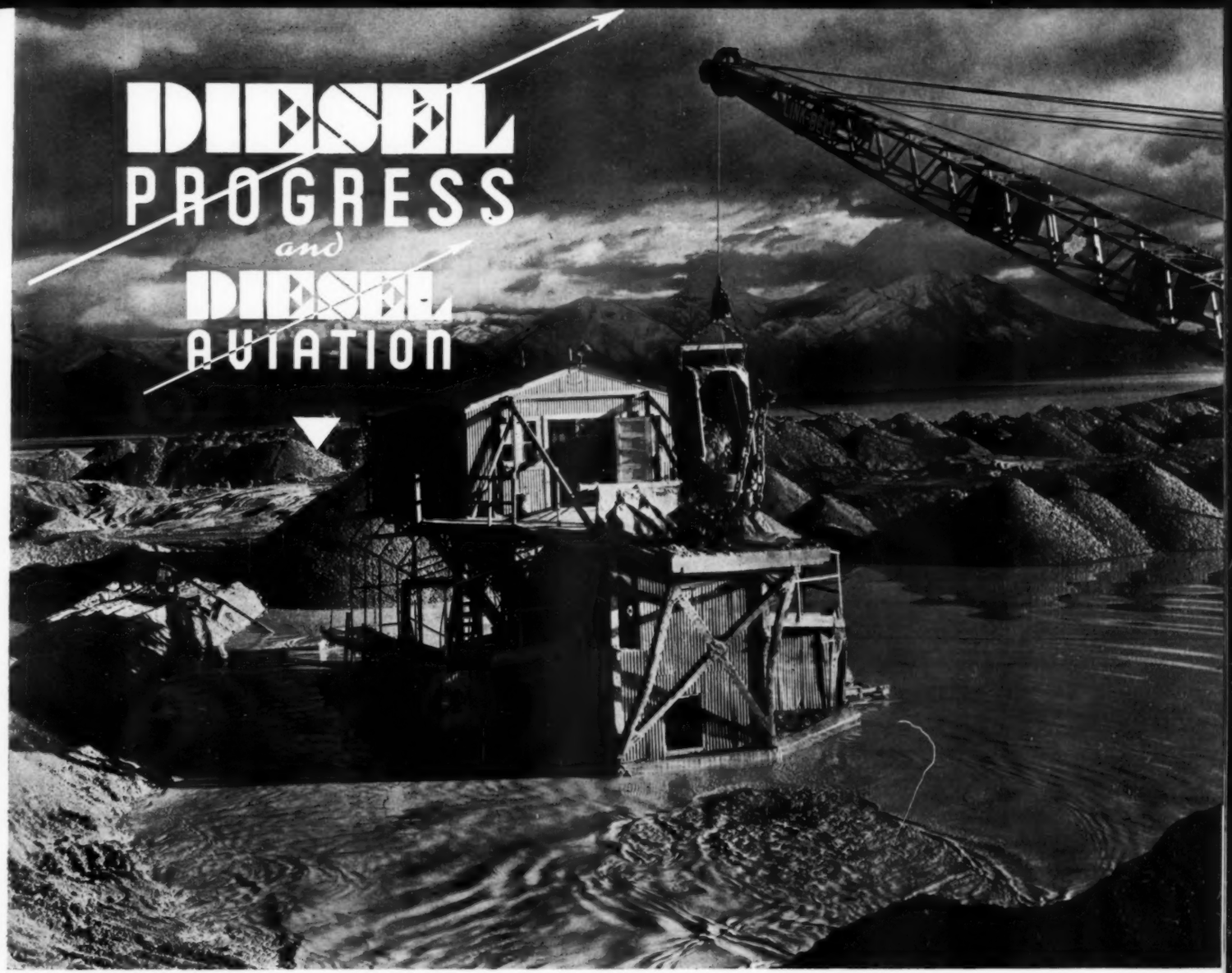
DIESEL PROGRESS for April, 1939. Volume V, No. 4. DIESEL PROGRESS is published monthly by Diesel Engines, Inc., 2 West Forty-fifth Street, New York, N. Y. Rex W. Wadman, President. Acceptance under the Act of June 5, 1934, at Brooklyn, New York, authorized May 14, 1935. Subscription rates: United States and Possessions $3.00. Canada and all other countries $5.00 per year. Single copy price 25 cents in U. S. A., 50 cents for all other countries.



REX W. WADMAN
Editor and Publisher

FRONT COVER ILLUSTRATION: Main entrance of the New York Public Library at the corner of 42nd Street and Fifth Avenue in New York City. See article on pages 48 and 49.

TABLE OF CONTENTS ILLUSTRATION: Placer mining operation twenty-four miles south of Beowawe, Nevada. A Caterpillar Diesel engine powers a Bodinson dredge, another Caterpillar powers a Link Belt two-yard dragline and a third Caterpillar Diesel drives a Fairbanks-Morse deep well turbine pump. In addition, a Caterpillar Diesel tractor builds the necessary levees. This is an operation of the Mill Gulch Placer Mining Co., Camp Raleigh, Beowawe, Nevada.

DIESEL PROGRESS for April, 1939, Vol. V, No. 4. Published monthly by Diesel Engines, Inc., 2 West 45th St., New York, N. Y. Tel. MUrray Hill 2-5092. Subscription rates: U.S.A. and Possessions $3.00 per year; 25c per copy. All other countries, $5.00 per year; 50c per copy.

HEYWORTH CAMPBELL
Art Director

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CCA

PHOENIX NOW HAS 14,000 HORSEPOWER

By REX W. WADMAN

THE Salt River Valley Water Users' Association's Diesel power plant at Tempe, Arizona, a few miles outside of Phoenix, is now operating with a pair of 7,000 hp. Hamilton-M.A.N. Diesel engines. The second engine was put on the line late last year. Many of our readers may remember a detailed description of this Tempe, Arizona, power plant which appeared in our August, 1938 issue, at which time full details of the layout were given in connection with the installation of the first 7,000 hp. unit. To those of our readers who haven't a copy of the August issue available and would care to have a reprint of this original article, communicate with the editor and it will be promptly sent to you.

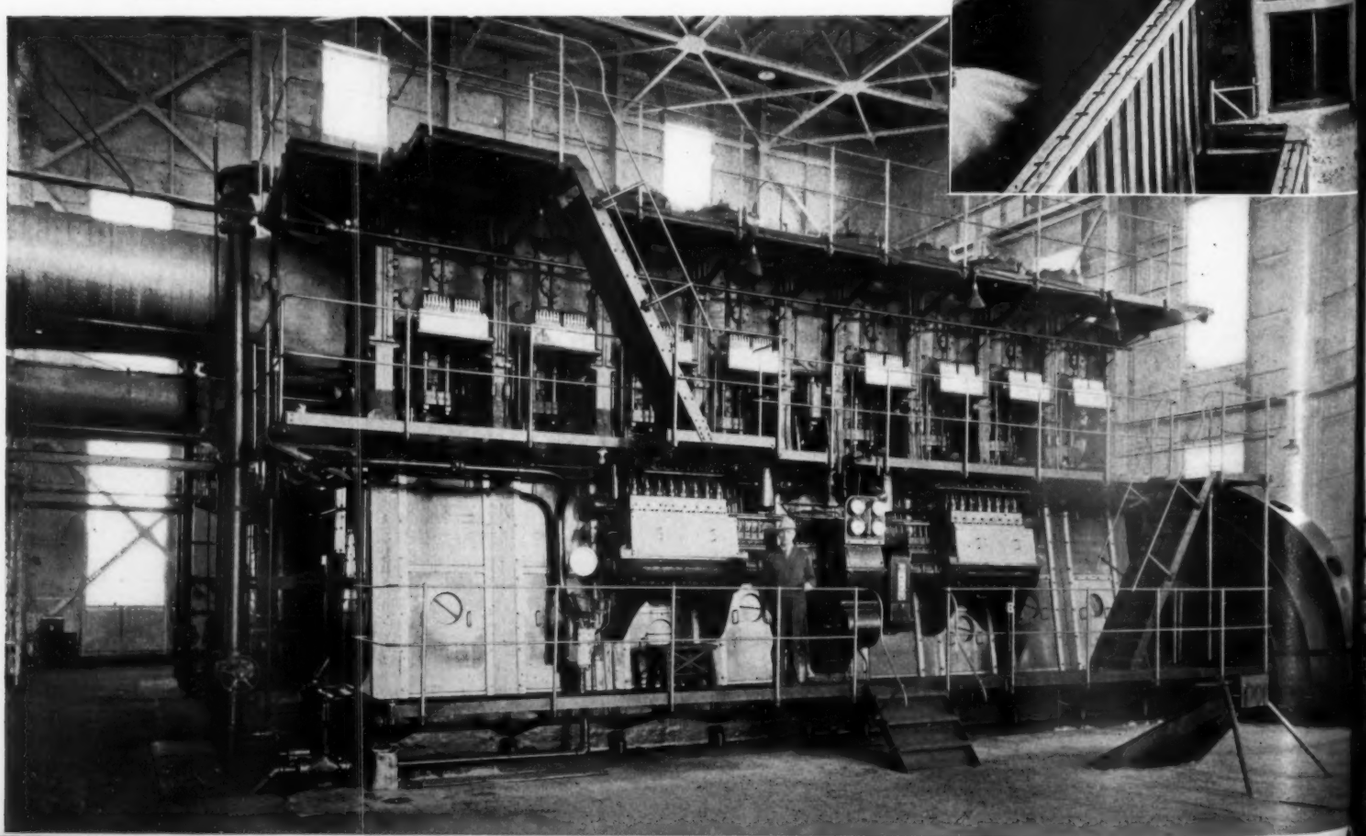
This installation has been highly successful in serving the purpose for which it was originally installed; namely, handling the load variations of the elaborate power system where load swings up to 4,000 kw. are not unusual. These large load swings are not instantaneous but cover an appreciable length of time of from 15 to 30 seconds. With the Diesel units regulating the speed of the system, the water power plants are given base loads at maximum output, resulting in more kilowatt hour output with a consequent reduction in kilowatt hour generated by fuel. The increased output of water power costs nothing as irrigation demand during the period from April to October exceeds the capacity of the water wheels to pass water, and water is by-passed in varying amounts practically continuously during these months.

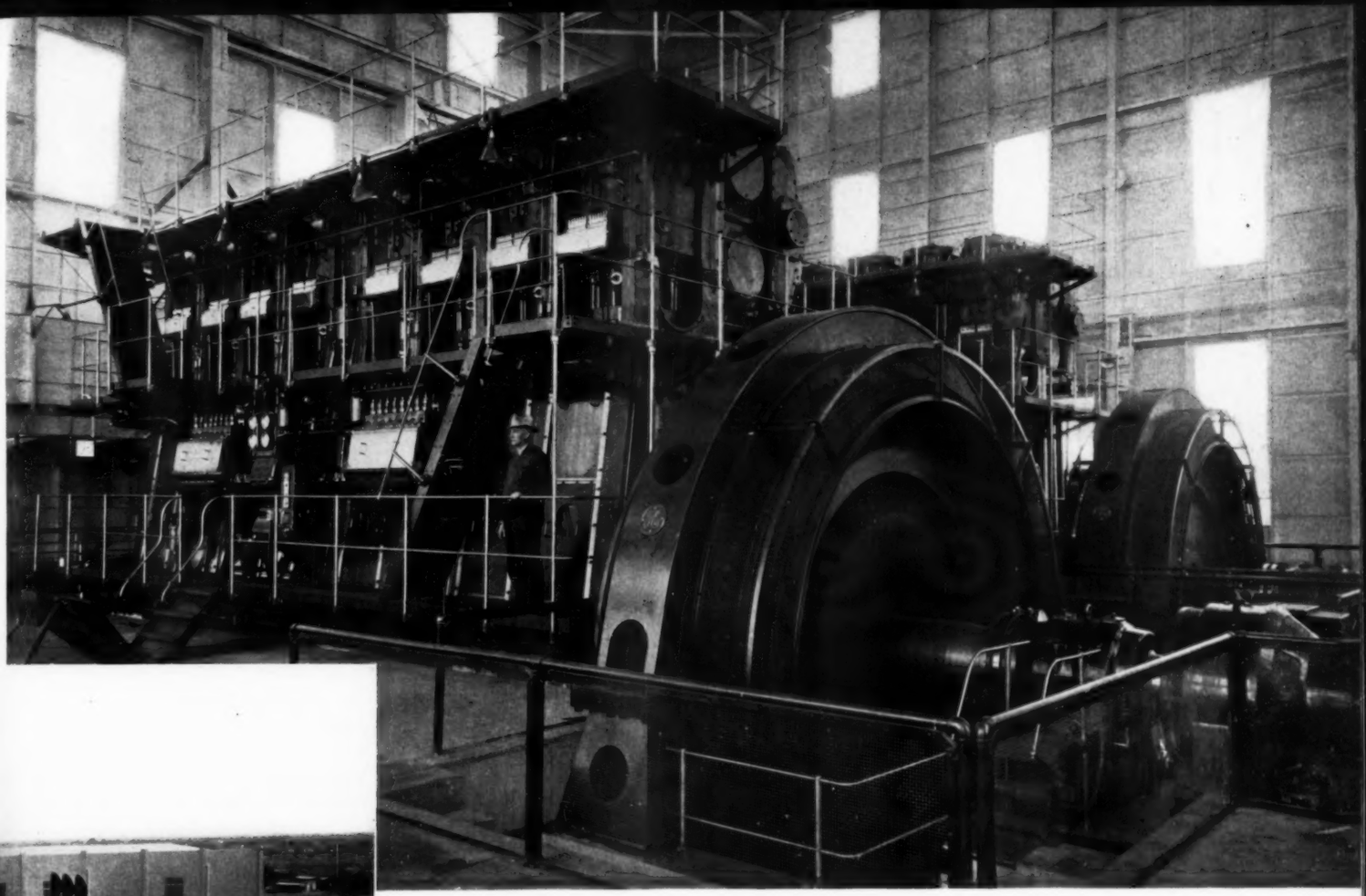
The economy of the Diesel is such that variations of load do not affect it to any considerable amount if the load does not go below one-half capacity.

Figures for the month of October, 1938, on the matter of fuel consumption for one engine operating only show that the plant produced 513 kwh. net at the switchboard per barrel of fuel. With fuel cost at $1.86934 per barrel, the fuel cost for October, 1938, was 3.644 mills per kwh. The total production cost for October was 4.566898 mills per kwh. for an output of 1,553,700 kwh. which was about 50 per cent load factor. This included no repairs for the engine was new.

Due to fine silt in the cooling water, the open cooling system, which was installed with the first engine, has not proved entirely satisfactory on account of the deposits of this fine material in the water passages of the engine. As a consequence, heat exchangers are now being installed for a closed cooling system to serve both engines in order to remedy this condition. Otherwise, the accessory equipment for the second engine is identical with the details we published last August.

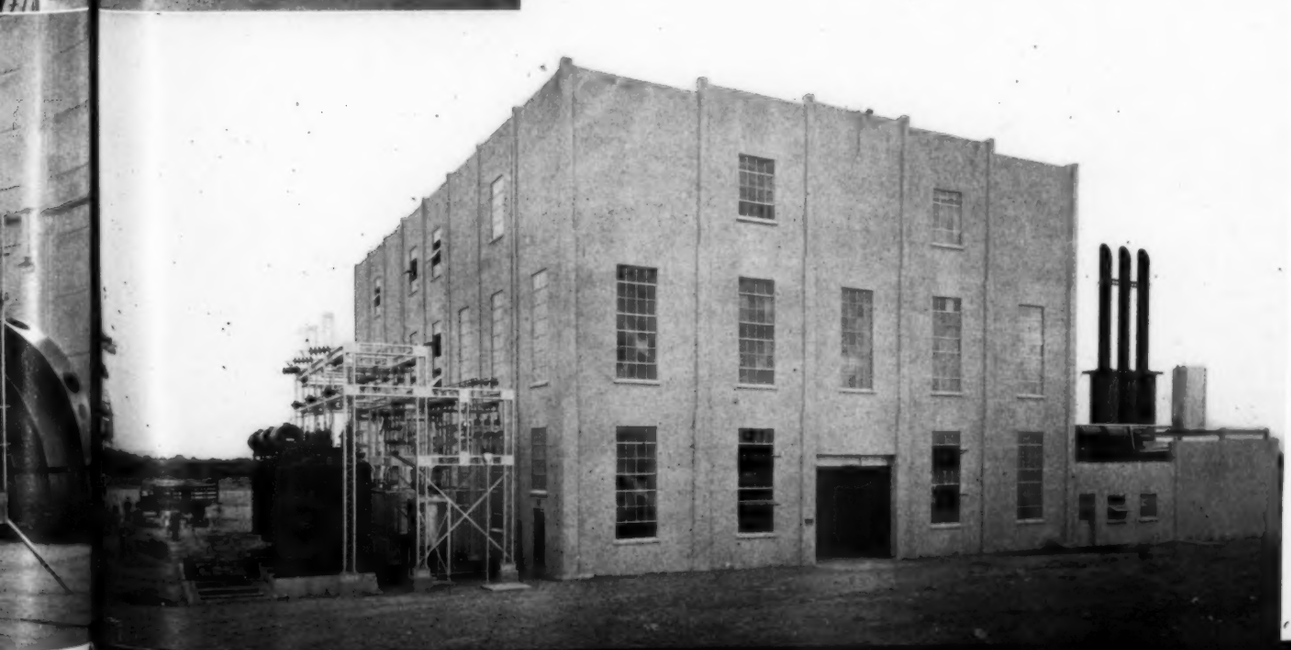
Below — General view of two 7,000 hp. Hamilton-M.A.N. Diesel engines in the Tempe, Arizona, Diesel power plant of the Salt River Valley Water Users' Association. At right — Two exteriors and one interior of the same plant.





The second engine, as recently installed, is, as stated above, a duplicate of the first and is a 7,000 hp. Hamilton-M.A.N., 8-cylinder, double acting, solid injection, bore 24 in., stroke 36 in. Diesel, manufactured by the Hooven, Owens, Rentschler Division of General Machinery Corporation, Hamilton, Ohio. This engine is direct-connected to 6,250 kva. General Electric 6,600 v. 25-cycle generator, with direct-connected exciter and pilot exciter with automatic voltage regulation.

As may be seen in the center illustration, a "dog house" is built out from the main building for each engine to house the 32,000 cu. ft. Allis-Chalmers scavenging blower driven by a 400 hp. induction motor. On top of this "dog house" is located the day tank for the fuel oil and to the right of each house is located the sunken exhaust pit on which is mounted the three large Maxim silencers. Air intake for both engines is taken through twenty Air-Maze air filter panels.



THE WATCHMAN OF VLADIVOSTOK

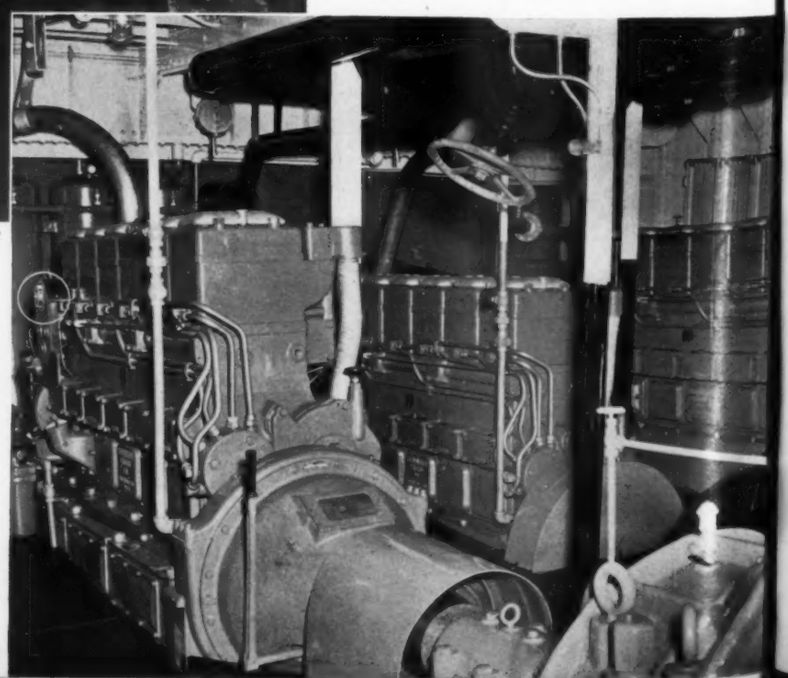
By WILL H. FULLERTON

DIESEL Fireboats have definitely made a place for themselves in the protection of waterfront cities. Further evidence of this was seen in the recent launching, at East Boothbay, Maine, of an all Diesel-powered fireboat for the Russian Government.

This new fireboat, designed by John G. Alden and built by Rice Brothers Corporation, is a duplicate, except for a few improvements, of the *City of Portland,* launched in 1931, by the same designer and builder. The Portland Fire Department is to be congratulated for being the first city on the Eastern Seaboard to realize the advantages of a fireboat powered by Diesel engines. Likewise, the Russian Government is to be commended for accepting, en toto, a design which has proved itself worthy.

The *Dozorniy,* which is the Russian word for *Watchman,* is 90 ft. long, 88 ft. 4 in. at the waterline, 22 ft. beam, and draws 6 ft. 3 in. when fully loaded.

The engine room layout is unusual. The center propelling engine aft, used for maneuvering only, is a Cummins Model KMR 6-cylinder 4-cycle 6¾″ bore by 9″ stroke 200 hp. Diesel engine, direct-connected to the propeller shaft through a Joe's reverse gear. (It will be seen



Above — The "Watchman" docked at East Boothbay, Me., for stationary pumping tests. Diesel engine exhaust is seen left at the water line. Right — The three after Diesel engines; the center engine connected to propeller only, the two wing engines connected to propellers and pumps.

that there are five engines of these same specifications in this boat.) The two wing propelling engines, which also serve for pumping, are identical to the center engine, except that they are fitted with Kinney sailing clutches on the tail shaft ends to permit running the engines disconnected from the propeller shafts, and on the forward ends with Twin Disc clutches which connect the engines to Dean Hill 8 in. 3-stage diffuser type centrifugal pumps. Forward of and in line with these two wing engines are two Model KI six-cylinder Cummins Diesels, the same as the other three engines except that they are equipped for pumping only, having been fitted with Falk flexible couplings to the Dean Hill pumps.

Between these two forward engines is a generating set made up of a Cummins Model H 4-cylinder 4-cycle 4⅞" bore by 6" stroke Diesel engine, direct-connected to a 20 kw. 125 v. DC Electro Dynamic generator. This unit is electrically started by two 12 v. Exide marine type Diesel engine starting batteries No. 6X25A and provides the electric power through a switchboard, furnished by the York and Boothby Company of Portland, for operating the lights, refrigerator, air compressor, bilge pump, floodlights, searchlights, windlass and other electrical equipment.

The fire boat "Dozorniy" has completed her tests and is awaiting shipment to Russia.

The five large engines are each equipped with U. S. temperature, fuel and lubricating oil pressure gauges, a Reliance Model D-9-C 100 to 1,200 rpm. tachometer and Nugent fuel and lubricating oil filters. The small engine is equipped with the same type gauges and lubricating oil filter, as well as a Cuno fuel filter. Air starting is used on the main engines being fed to all six cylinders and is furnished by two Gardner-Denver vertical tandem 2-stage air compressors each driven through Vee belts by two Imperial Electric drip-proof motors equipped with Cutler Hammer controls. Because these engines start very quickly on a minimum of air, one compressor is sufficient for all starting needs, the other being used mainly as a standby unit.

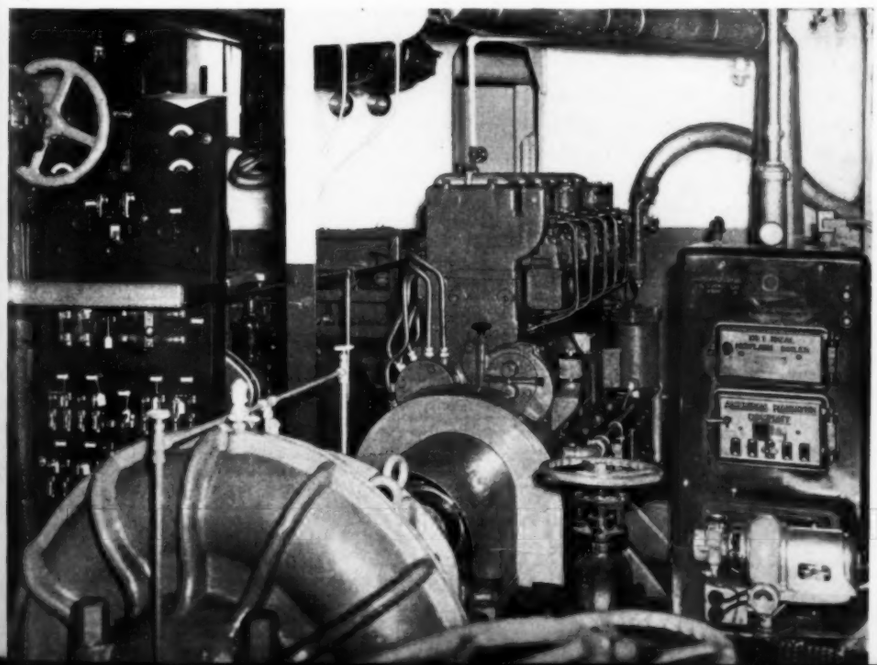
Fuel oil is drawn from the main tanks by a Viking rotary vane pump direct-connected to a General Electric motor and is pumped into two day tanks located amidships on opposite sides of the engine room, from where it flows by gravity to the engines.

During such times as it is advisable to shut down the generating unit, the electrical demand for power and light is provided for by a bank of Exide batteries furnishing 115-volt current through the switchboard.

A La Bour self-priming centrifugal 30 to 80 gpm. pump driven by a E. P. Allis electric motor was furnished for pumping out the bilge, supplying water for washing down and other purposes.

The American Engineering Company's winch mounted on the forward deck is one of the many electrically operated appliances. The compass and binnacle, of a modern design, was supplied by Kelvin White Company. Not only the propelling and pumping engines but also other engine room equipment and even the boat itself was built under the supervision of the American Bureau of Shipping.

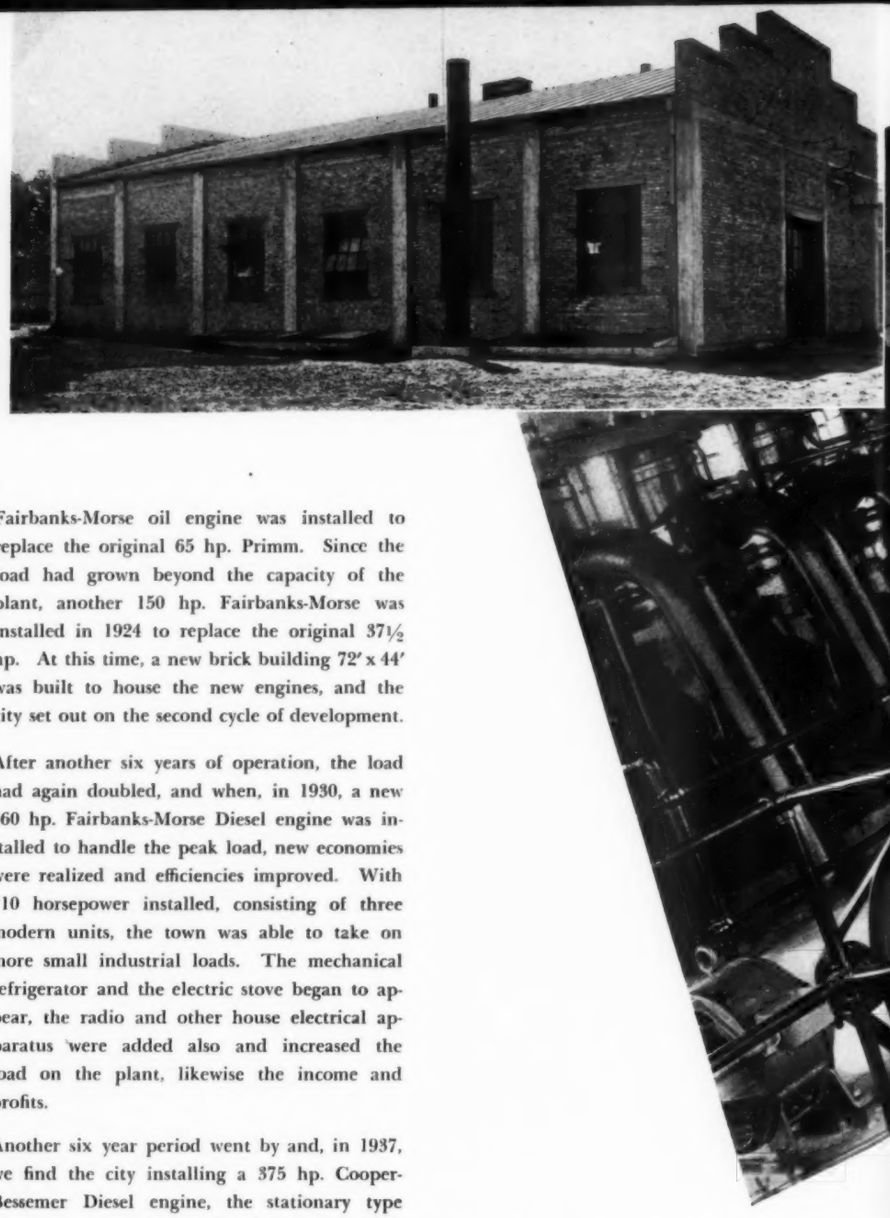
As soon as all tests have been completed, this new fireboat will be taken to New York where she will be loaded onto a steamer for shipment to her home port of Vladivostok.



There are two wing engines forward equipped for pumping only and a 20 kw. Diesel electric generating set between them.

SHINER, TEXAS

By ORVILLE ADAMS



Upper left — View of the modern building which houses the Shiner, Texas, Light Plant. Above, center — Interior view of engine room showing the 375 hp. Cooper-Bessemer Diesel engine in the foreground. To the right is a view of the 360 hp. Fairbanks-Morse Diesel engine.

THE feasibility of a Diesel driven municipal light plant in a town having a population under 1,500 is sometimes questioned, even in the face of records which show outstanding success with such projects. The experience with this type of plant, extending over nearly thirty years at Shiner, Texas, is a case history whose details and history of development are indeed interesting. This little South Central Texas city, surrounded by a progressive farming community, now claims a population of 1,400. Its local industries; such as, a cotton seed oil mill, creamery, brewery, cotton compress, a local wire works, a feed mill enterprise, and the like, represent the necessary industrial self-sufficiency required for an adequately developed rural community town.

The light plant at Shiner had a typical beginning: The World War was on when the first plant was built, the city paying $10,000 for this plant in 1915, installing at that time a 50 hp. boiler and a steam engine belted to a generator, all housed in a 40′ x 30′ building.

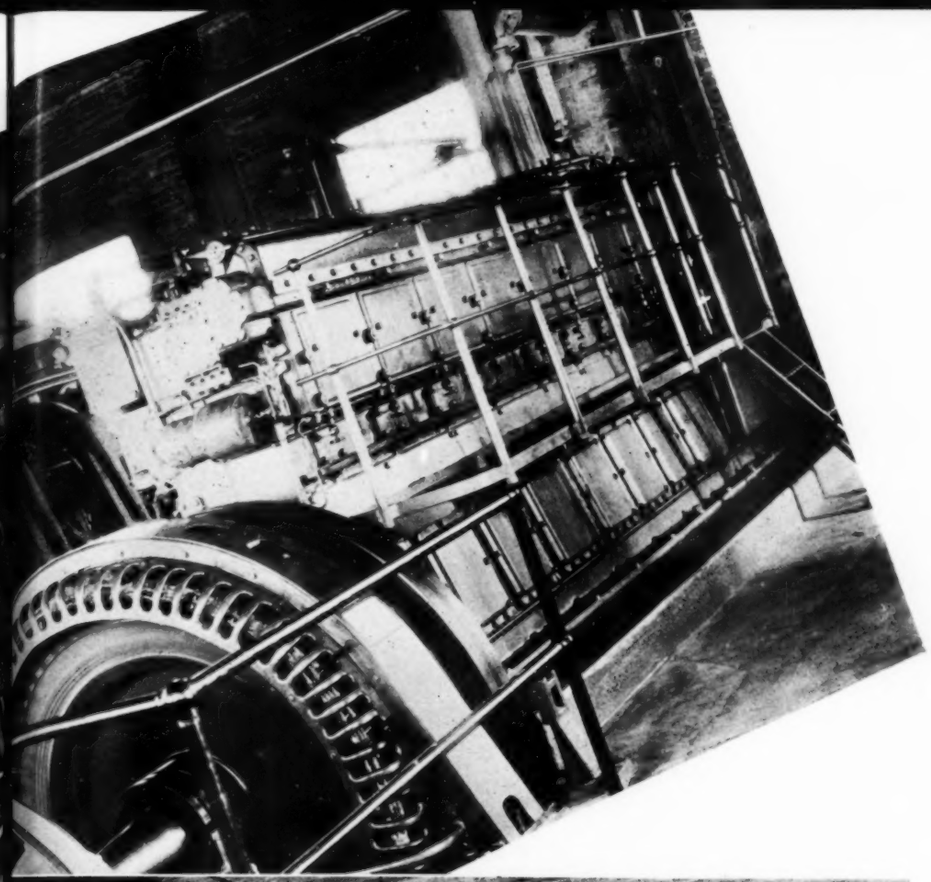
The people had lights then, only between the hours of 5 and 12 P.M., and again at 4 to 8 A.M. and paid 17½ cents per kilowatt. The operation of the steam engine on peak periods only, even at such a high rate, did not promise success for this new adventure in municipal operation, and the very next year (1916) the first oil engine was installed, this being the well-remembered 65 hp. Primm, a horizontal, low compression, oil engine. The manufacture of electricity at Shiner, at such low cost at that time, resulted in a greater demand for current at other periods, and a year later (1917), the town installed one 37½ hp. Fairbanks-Morse oil engine which started in operation in 1917. With current available 24 hours a day at much lower cost, the people felt well satisfied with their first two years experience in municipal operation. After America entered the World War, with consequent confusion and restrictions, little or no expansion was possible until six years later (1923), when a 100 hp. Fairbanks-Morse oil engine was installed to replace the original 65 hp. Primm. Since the load had grown beyond the capacity of the plant, another 150 hp. Fairbanks-Morse was installed in 1924 to replace the original 37½ hp. At this time, a new brick building 72′ x 44′ was built to house the new engines, and the city set out on the second cycle of development.

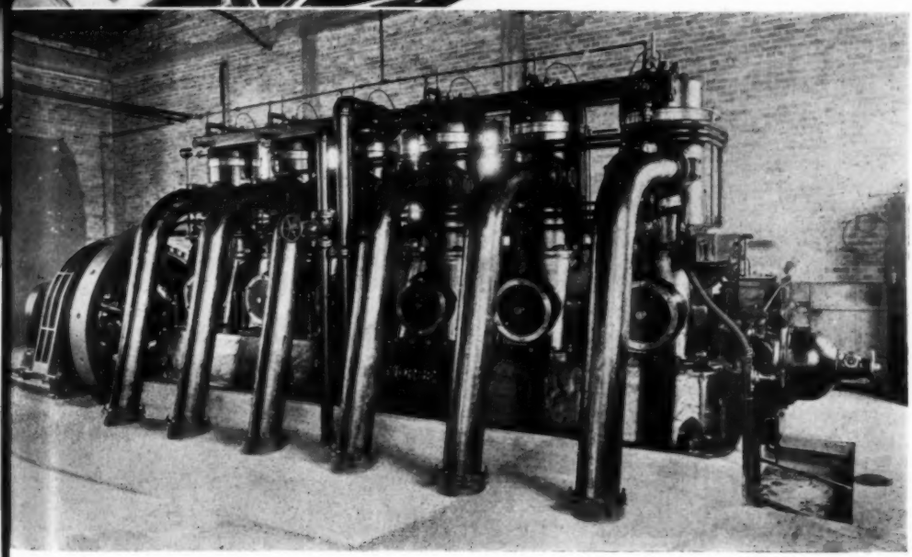
After another six years of operation, the load had again doubled, and when, in 1930, a new 360 hp. Fairbanks-Morse Diesel engine was installed to handle the peak load, new economies were realized and efficiencies improved. With 710 horsepower installed, consisting of three modern units, the town was able to take on more small industrial loads. The mechanical refrigerator and the electric stove began to appear, the radio and other house electrical apparatus were added also and increased the load on the plant, likewise the income and profits.

Another six year period went by and, in 1937, we find the city installing a 375 hp. Cooper-Bessemer Diesel engine, the stationary type J.T., a four cycle, solid injection, constant pressure atmospheric relief system type engine of modern design and construction, this engine replacing the 100 hp. low compression oil engine that had served the city for nearly fifteen years. With its present installed capacity of 615 kw., the city is making history for efficiency and earnings. The total gross output is better than 750,000 kilowatts annually, produced on approximately 91,191 gallons of fuel oil, which was sold for a total of a little more than $35,000, realizing slightly more than 5 cents per kilowatt for current produced. The total expenses, including payment on plant debt, is about half the gross revenue.

It is not surprising to find that all the engines and improvements were paid for out of plant revenue, but it is remarkable that, in addition to paying for the plant itself, the following improvements are inventoried by officials as having been built out of light plant income: City hall, cost $30,000; water works, cost $40,000; sewer system, cost $45,000; fire equipment, high pressure pumper, cost $8,000; water well for water works, cost $11,000, and the second deep well, cost $6,000. Many similar towns even in the same section of the state, without municipal revenues, have not been able to add these essential city improvements and even today are doing without them, or building them with government grants.

In addition to its three engines consisting of a total of 885 hp., housed in a new brick building, the city has added other equipment; such as,





modern switchboard with voltage regulator and regulated frequency, cooling water towers, centrifuge, circulating pumps, a Zeolite cooling water softener, and a 22,000 gal. storage tank. The latest engine is equipped with a DO-4 Maxim silencer, arranged horizontally and connected to a vertical riser from the engine manifold. The air filter is also installed in this manner and located outside the building, being a 3-unit American air filter. An Alnor pyrometer is used on the new engine.

EXAMPLE OF OPERATING RECORDS

Year	*Kwh.*	*Operating cost*	*Revenue collected*
1935	680,700	$8,213.43	$19,097.58
1936	718,700	7,571.20	21,936.85
1937	752,600	8,401.37	32,218.40
1938	791,300	8,501.20	29,355.97

Under operating cost is included labor, lubricating oil, fuel oil, repairs, supplies, and other miscellaneous items, but does not include line construction cost and line material.

OPERATING PROCEDURE

	150 hp. F.M. engine	*360 hp. F.M. engine*	*375 hp. CB engine*
Lube Oil Used, 319 Gallons		549	335
Fuel Oil, 16,610		34,035	41,360
Hours Operated, 2,358		2,649	3,713

The Cooper-Bessemer engine operating data is as follows:

	August	*September*
Fuel oil	4,120 gal.	3,935 gal.
Kwh. output	41,500	38,600
Kwh. per gallon	10.07	9.76

The engine generated a total of 80,100 kwhrs. in 720 hours, and used only 94 gallons of lubricating oil, giving 852.1 kwhrs. per gallon, or .01305 gallons per hour run.

The city has 572 light customers, who pay the following rates for service:

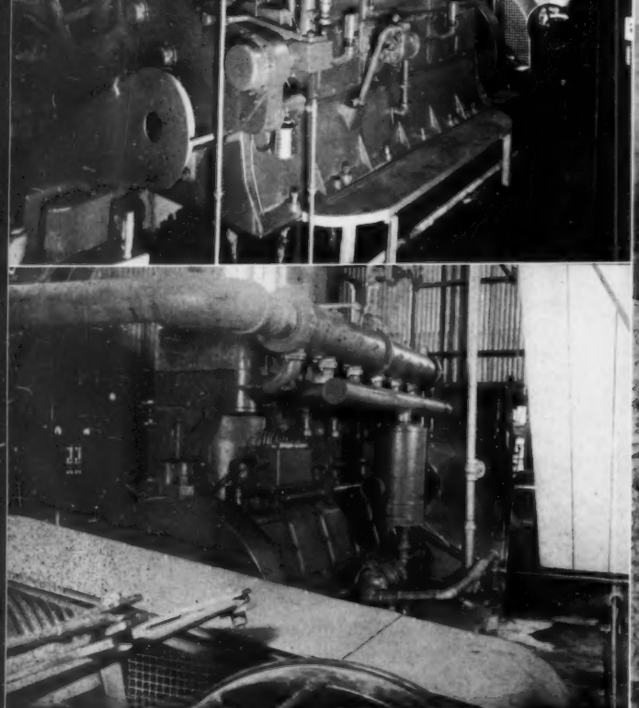
First 10 kwhrs. at $1.25, next 40 kwhrs. at 10 cents, next 50 kwhrs. at 8 cents, next 100 kwhrs. at 6 cents, and all over at 5 cents, with the minimum charge of $1.25 per month. The motor rate requires a minimum of $1.00 per hp., with the first 300 kw. at 4 cents, next 400 at 3 cents, and all over 700 kwhrs. at 2 cents.

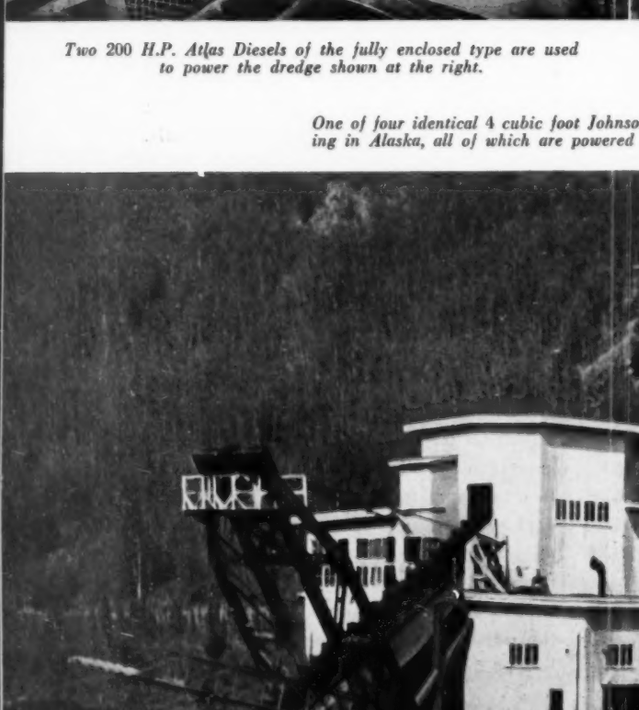
The city is contributing free the following services, for which no charge is made; namely, street lighting, lights and water to the schools and city hall.

The reliability of the operation is shown by the fact that the current has not been off the lines, except for a few moments due to engine trouble, since 1922. The value of the free municipal service is figured more than $5,000 per year, in addition to $8,000 to $10,000 transferred to the general fund. After deducting operating expenses, annual depreciation of around $4,500, and paying $4,000 on the plant debt, the net profit is figured at better than $15,000 yearly.

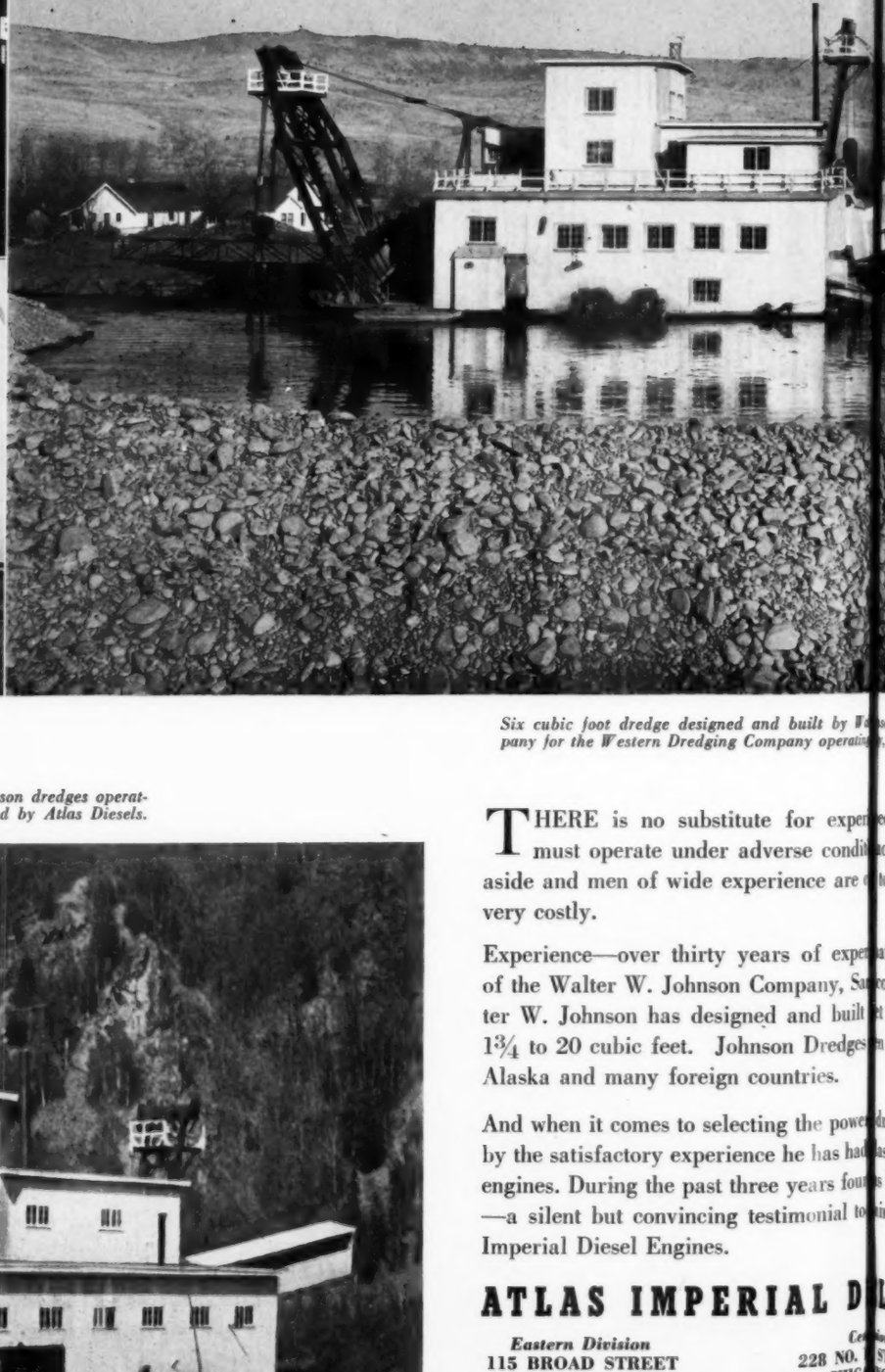
The unbroken record of more than twenty-five years of loyal support of this plant by its citizens results in some remarkable records. Every citizen uses all the current he needs and wants. Its industries use its power. As 50 per cent of the money paid for bills returns to the people in net profits, they take full advantage of the low cost power and light. The consumption of current per capita is one of the highest on record for similar towns, averaging more than 500 kilowatts annually, which means that for every person living in the city, the city collects $25.00 in gross revenue on its utilities service, with the result that every home enjoys the maximum service, and every citizen makes a large and useful contribution to the improvement of the city's schools, streets, and the like by means of his share in the net profits.

Experience dictates Wh





Two 200 H.P. Atlas Diesels of the fully enclosed type are used to power the dredge shown at the right.



Six cubic foot dredge designed and built by W[illegible]son Company for the Western Dredging Company operati[illegible], Oregon.

One of four identical 4 cubic foot Johnson dredges operating in Alaska, all of which are powered by Atlas Diesels.

THERE is no substitute for exper[illegible]ecially w[illegible] must operate under adverse condi[illegible]ccessible[illegible] aside and men of wide experience are [illegible] to obviat[illegible] very costly.

Experience—over thirty years of expe[illegible]at's the k[illegible] of the Walter W. Johnson Company, Sa[illegible]o Dredg[illegible] ter W. Johnson has designed and built [illegible]t type dr[illegible] 1¾ to 20 cubic feet. Johnson Dredges [illegible]n shipped[illegible] Alaska and many foreign countries.

And when it comes to selecting the powe[illegible]dredges, [illegible] by the satisfactory experience he has had [illegible]as Imper[illegible] engines. During the past three years four[illegible]s Diesels [illegible] —a silent but convincing testimonial to [illegible]ina, depe[illegible] Imperial Diesel Engines.

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CHIC[illegible]NOIS

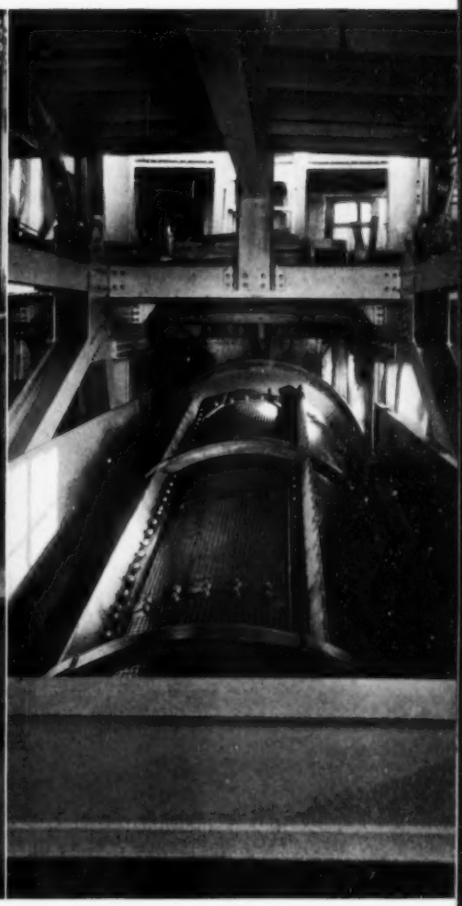
Gloucester—Providence—Philadelphia—Baltimore—C[illegible] Miami—Jac[illegible]
Fort Worth—Houston—El Paso—Terminal Island[illegible] Portland—V[illegible]

ATLAS Imperia[illegible] IES

Walter Johnson's Choice

*built by Wa son Com-
ny operating , Oregon.*

Atlas Diesel Electric power plant in a 2½ cubic foot dredge operated by the Boundary Dredging Company in Canyon Creek, Forty Mile District, Alaska.



Characteristic rugged construction of the revolving screens as employed in Johnson's six cubic foot dredges.

This is a 2½ cubic foot dredge with mechanical drive, Atlas Diesel powered, operated by the Bristol Bay Mining Company in Wattamus Creek, Goodnews Bay District, Alaska.

for experi ecially when designing equipment which rse condit ccessible locations. Theories are brushed ence are to obviate mistakes which might prove

of experi at's the keynote of the outstanding success pany, Sa o Dredge Designers. Since 1906, Wal- and built t type dredges, ranging in capacities from Dredges n shipped throughout the Western States, tries.

the power dredges, Mr. Johnson's choice is dictated e has had as Imperial Heavy Duty, Medium Speed years four s Diesels have gone into Johnson Dredges monial to ina, dependability and economy of Atlas

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Imperia
IESEL ENGINES

DIESEL AVIATION

NEW DIESEL FOR TRANSATLANTIC SE

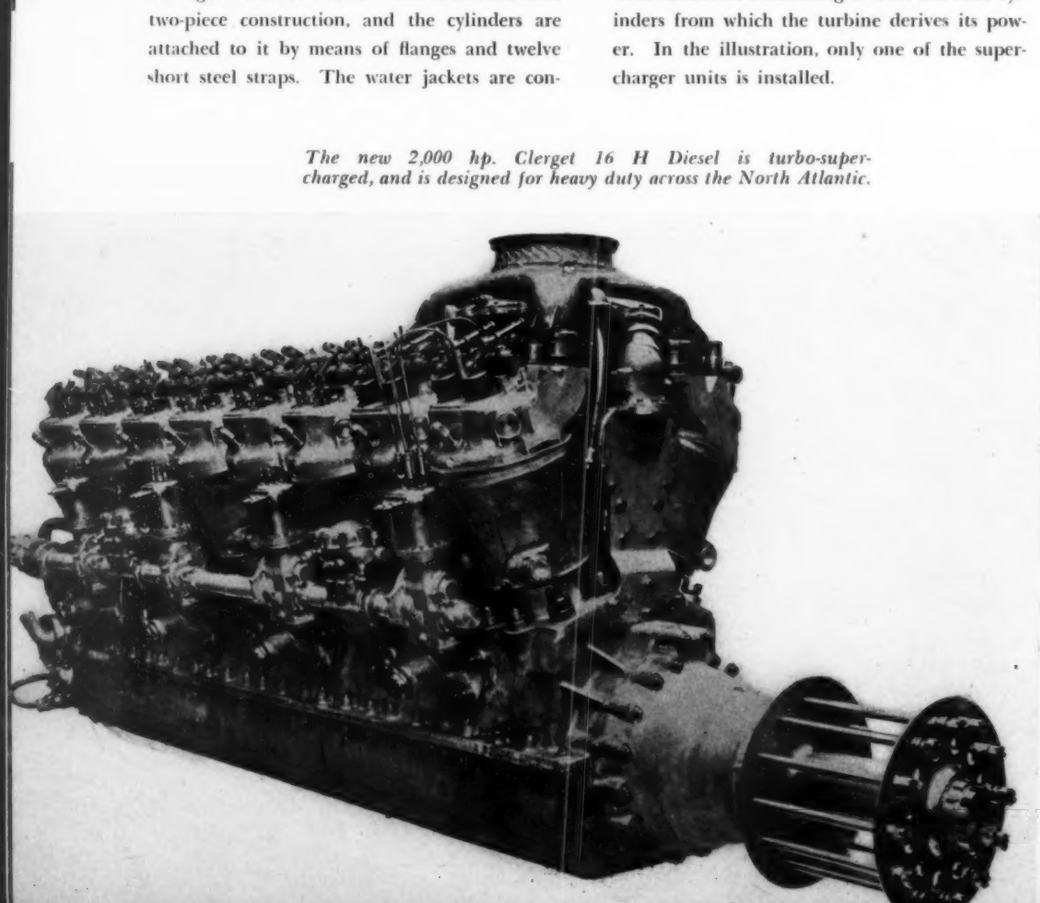
By PAUL H. WILKINSON

FRANCE has been quite prolific in the development of Diesel aircraft engines, and three of these power plants were exhibited at the recent Paris Aero Show. Two of these engines, built by Coatalen and Jalbert-Loire, have already been described in DIESEL PROGRESS, and the third one is the new 2,000 hp. Clerget *16 H* Diesel. At the Show, it carried a placard designating it as "type transatlantique," and it looks powerful enough for this kind of service.

The Clerget *16 H* Diesel is water-cooled, and its sixteen individual steel-jacketed cylinders are arranged in two banks with an angle of 45 degrees between them. The crankcase is of two-piece construction, and the cylinders are attached to it by means of flanges and twelve short steel straps. The water jackets are connected to centrifugal-type water pumps at the end of each bank of cylinders. Two inlet and two exhaust valves are provided in each cylinder head where they are operated by roller rocker arms and short push rods from overhead camshafts. There are four lugs along each side of the crankcase for mounting the engine.

The supercharger installation is unusual in that there are four exhaust-driven superchargers mounted horizontally on top of the engine, one for each group of four cylinders. Underneath each gas turbine and coupled to it by a short drive shaft, is a centrifugal-type compressor with manifolds connecting it with the four cylinders from which the turbine derives its power. In the illustration, only one of the supercharger units is installed.

The new 2,000 hp. Clerget 16 H Diesel is turbo-supercharged, and is designed for heavy duty across the North Atlantic.

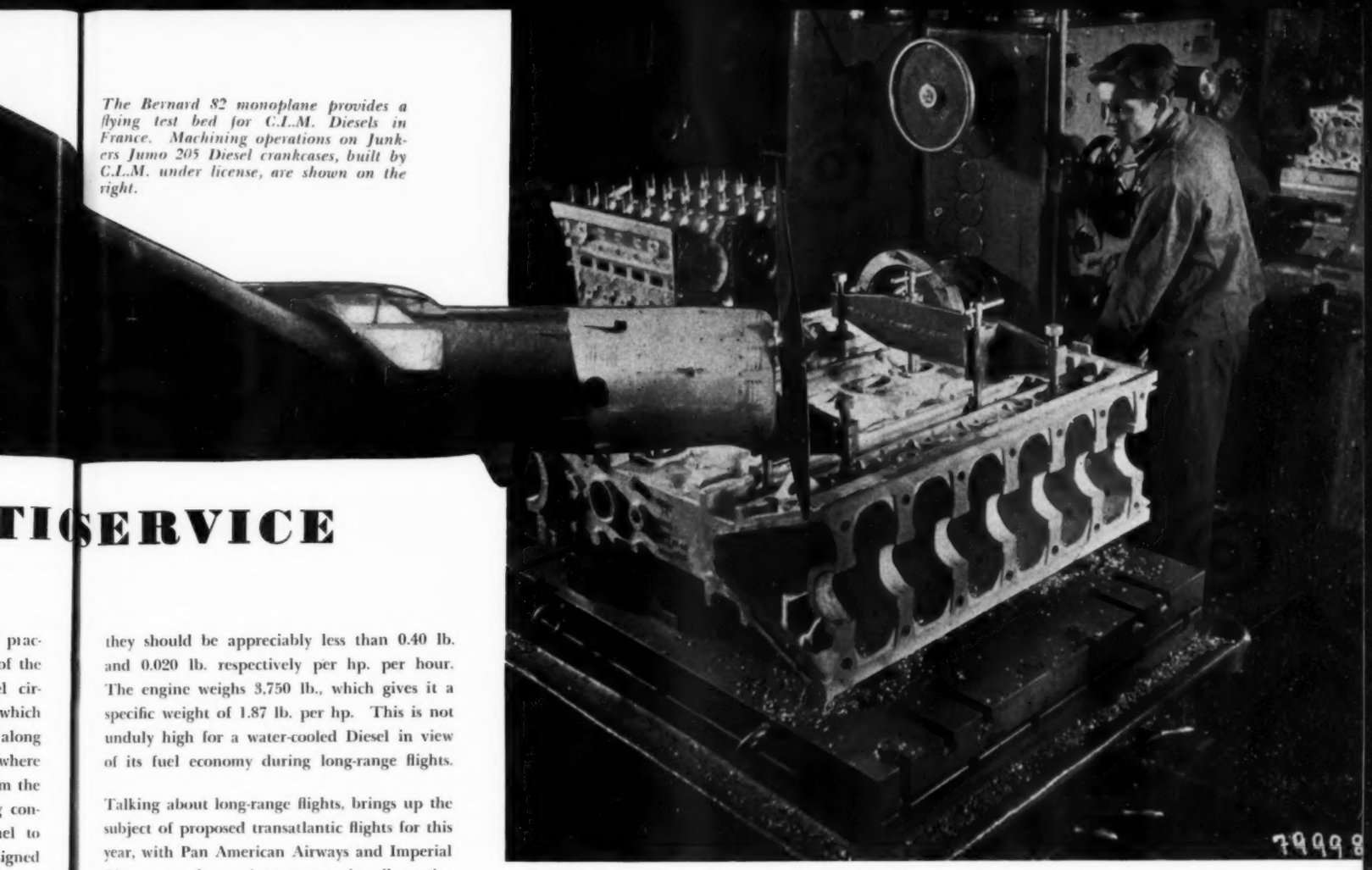


The fuel injection system follows Clerget practice in that the high-pressure pumps are of the bi-fuel type, with two independent fuel circuits for each cylinder. The fuel pumps, which are of Clerget manufacture, are mounted along the outside of each bank of cylinders where they are actuated by camshafts driven from the rear of the engine. Each pump housing contains four pump units which supply fuel to two adjacent cylinders. Specially designed transfer pumps located between the pump housings and driven from the camshafts, supply fuel to the injection pumps. The two spring-loaded fuel injectors in each cylinder head, are also of Clerget manufacture.

For take-off, the Clerget *16 H* Diesel is rated at 1,800 hp. at 2,100 rpm., and it develops a maximum of 2,000 hp. at 2,200 rpm. Its maximum continuous cruising output, is stated to be 1,600 hp. at 2,000 rpm., which means that efficient operation and low fuel consumption should be obtained at 75 per cent power output, or 1,500 hp. At present, its rated altitude is given as 8,200 ft., which certainly is conservative considering its supercharging equipment. The engine has a compression ratio of 14 : 1, and a maximum B.M.E.P. of 145 lb. per sq. in. It operates on the four-cycle principle.

The new French power plant has a displacement of 4,970 cu. in. and with its superchargers, it is 112 in. long, 31 in. wide and 49 in. high. Despite these imposing dimensions, its frontal area is less than 11 sq. ft., which certainly is not excessive for such a powerful engine.

Fuel and lubricating oil consumptions are not available, but based on other Clerget engines.



The Bernard 82 monoplane provides a flying test bed for C.I.M. Diesels in France. Machining operations on Junkers Jumo 205 Diesel crankcases, built by C.I.M. under license, are shown on the right.

TI SERVICE

they should be appreciably less than 0.40 lb. and 0.020 lb. respectively per hp. per hour. The engine weighs 3,750 lb., which gives it a specific weight of 1.87 lb. per hp. This is not unduly high for a water-cooled Diesel in view of its fuel economy during long-range flights.

Talking about long-range flights, brings up the subject of proposed transatlantic flights for this year, with Pan American Airways and Imperial Airways ready to inaugurate airmail service with gasoline-engined flying boats. There will not be any "74-passenger" service on this route, however, despite the use of this high sounding phrase in the daily press. As for the many tons of highly inflammable gasoline which these planes will be forced to carry, their personnel and payload would be much safer if it were Diesel fuel.

It is fairly safe to predict that efforts will be made again this year by opponents of the Diesel, to keep aircraft equipped with this ultra-modern power plant from service *on a payload basis* across the North Atlantic. For the past two years, certain interests in the United States have employed these unsportsmanlike tactics, and it is highly probable that they will be used again. It is easy to see that the operators of gasoline-engined airplanes are afraid to have their equipment compete with Diesel-engined airplanes.

Readers of DIESEL PROGRESS can see for themselves how the Diesel aircraft engine situation is misconstrued by referring to the article of Sherman B. Altick, aviation editor of *The New York Sun*, in his "Across the Skyways" column of January 28, 1939. Mr. Altick says he went "behind the scenes to obtain the actual facts" about the situation. Unfortunately, the source of the information which he received, is not disclosed. This is not surprising, considering the multitude of inaccuracies which the article contains.

Mr. Altick made some startling discoveries behind the scenes. For instance, he says, "it was found that the weight factor completely overshadows the fuel economies of Diesel engines compared to gasoline motors. It was found that Diesel power plants have a 12 per cent advantage over gasoline motors in fuel consumption, but the former weigh three-fourths of a pound more to the horse power than gasoline types."

While he was focussing attention on the greater weight of the engine, Mr. Altick conveniently overlooked a still more important factor. He forgot to mention the tremendous saving in fuel weight due to the lower fuel consumption of the Diesel which for a flight of appreciable duration, more than offsets the slight increase in engine weight. He also omitted to explain how the gasoline engine has reduced its fuel consumption to less than 0.40 lb. per hp. per hour — which is necessary if it is to consume only 12 per cent more fuel than the Diesel. Last, but not least, there is another little matter which he conveniently overlooked, and that is the great difference in the price of fuel used by the engines, which is definitely in favor of the Diesel. But why bother with such trifles, when the Diesel must be belittled at any cost?

There is a lot more of this nonsense relative to the Diesel aircraft engine in this article in *The New York Sun*. The write-up is clever, and doubtless it has fooled a good many people, even in the aviation world. Although the article doubtless was inspired by certain interests, it would have been a wise procedure for the writer to have checked the facts and fallacies before they appeared in print. Mr. Altick recently won top honors in Transcontinental Western Air's newspaper and magazine contest for "consistently developing the best informed air transport writing" during 1938. It is to be regretted that he has not put his talents to better use than by a ridiculous attack upon the Diesel, which by its very absurdity, exposes his complete ignorance of the subject.

General engine room view showing the five self- contained "Packaged Power" units with individual control panels in the background.

HARDWARE MANUFACTURER USES DIESELS

By WILBUR W. YOUNG

THE first industrial installation of General Motors, Series 71, Diesel engines is running the Thomas Laughlin plant at Portland, Maine. This is a group of five Model 6-71RA1 90 hp. 6-cylinder 2-cycle engines direct-connected to five General Electric 440 v. 60 kw. generators and outboard General Electric 125 v. exciters operating at 1,200 rpm. The total connected load, at present, is somewhat more than 500 hp., whereas the total rated capacity of the engines is 450 horsepower. The temporary overload is distributed electrically on all five engines.

Founded in 1866, The Thomas Laughlin Company has built up a sizable plant for the manufacture of drop-forged marine and industrial hardware. Right now a modern, Austin-designed addition is under construction, while the older units of the plant are undergoing thorough remodeling. While these changes will result in greater manufacturing capacity, the ultimate power load will be 440 horsepower, which is well within the rating of the Diesel plant. This will be accomplished by modernization of power equipment with a resultant 80 per cent power factor, as compared to the present 60 per cent power factor. It is especially in-

teresting to observe that here is another case added to the growing list where Diesels have been installed as part of a general modernization program.

Each of the "Packaged Power" units is a self-contained power plant with all the necessary accessories which permits operation singly or in any multiples of the group. For example, two engines are operated continuously ten hours a day, while three engines operate nine hours a day, with an hour's shut-down during the lunch period. One engine can be cut out for service at any time without disturbing the mechanical set up of the remaining four engines. The advantages of several small units of this sort are many and obvious.

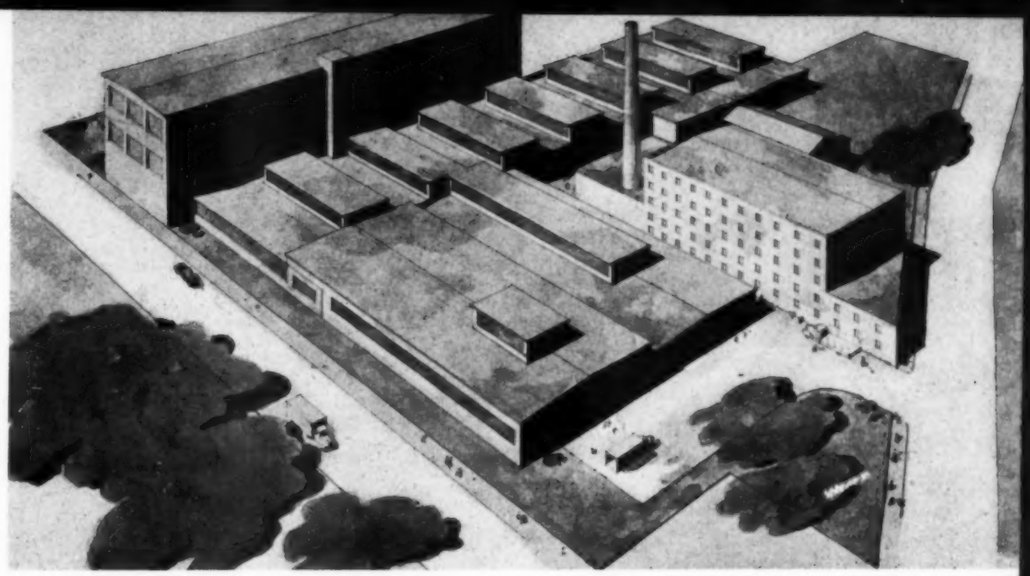
The accessories installed on each engine include a Woodward Type S6A9 governor, two heavy-duty AC air cleaners, a Delco-Remy 24 v. starting motor, a 26 v. battery charging generator, and Delco starting batteries, a Model HE 116-251 Harrison Radiator jacket water cooler, a Type N-17 Purolator lube oil filter, AC fuel oil filter, and Burgess exhaust silencer. A 52 gal. fuel oil day tank is mounted in the base of each engine, with a camshaft-driven Evans fuel pump to supply fuel to the injectors at low pressure.

Several interesting features have been incorporated into these engines: The built-in scavenging blower, water pump, oil cooler, governor, and fuel pump can be placed on either side of the engine regardless of the direction of rotation. Likewise, the exhaust manifold and water outlet manifold may be placed on either side of the engine. Even the starting motor can be placed on either the right or left side of the flywheel housing, independent of all other accessories. The crankshaft can be rotated either clockwise or counterclockwise. Smooth operation is secured by means of a completely counterbalanced crankshaft, with crank arrangement and firing order selected to eliminate unbalanced reciprocating forces. The small amount of vibration is easily absorbed in simple rubber mountings. Uniform bearing temperatures are insured by an ample supply of lubricating oil forced under pressure to all important bearings. Pistons and piston rings are cooled by a spray of lubricating oil from a jet at the top end of the connecting rods. The fuel injector combines the spray nozzle and the high pressure fuel pump in a single, removable unit. This system eliminates high pressure fuel lines.

The scavenging process in these engines employs the uniflow principle. A built-in blower supplies fresh air needed for combustion and scavenging. Two hollow aluminum rotors, each with three lobes, revolve with close clearances in an aluminum housing bolted to the side of the engine. To provide continuous and uniform displacement of air, the rotor lobes are made with a helical form. Three lobes are provided to insure a continuous flow. Air entering the blower inlet from the air cleaner is picked up by the lobes and carried to the discharge side of the blower. The continuous discharge of fresh air from the blower creates an air pressure of about seven pounds per square inch in the air chamber of the cylinder block. This pre-compressed air sweeps through the belt of intake ports as soon as the piston uncovers these openings. The slope of the intake ports imparts a rotational motion to the intake air as it enters the cylinder, insuring the expulsion of all traces of burnt gas through the exhaust valves into the manifold.

The cooling system is the simple closed jacket water type with soft water make-up from city mains. Cooling water is supplied from a deep well on the premises by a 200 gpm. Worthington rotary pump direct-connected to a 10 hp. Master Electric motor. Cooling water is returned to the well after circulation through the heat exchangers. With all engines running over long periods, it is necessary to make up cooling water from city mains for a half hour, or so, a day.

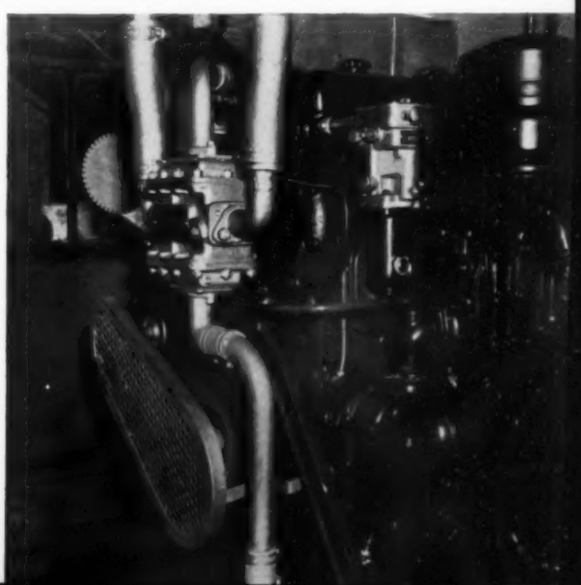
Allis Chalmers supplied the multiple control panel with Weston voltmeters, ammeters, and voltage regulators, with solenoid switches for each engine. Fuel oil is No. 2 Diesel Colonial Esso and lube oil is Colonial Esso S.A.E. No. 30. This Diesel installation is operating on an overall fuel economy of .008 per kw. In operation only a few months, it is paying for itself in power economies. It carried the Thomas Laughlin plant through the hurricane last fall. While connection with utility power lines will be maintained, there is manifest satisfaction in having control of basic power requiremets.

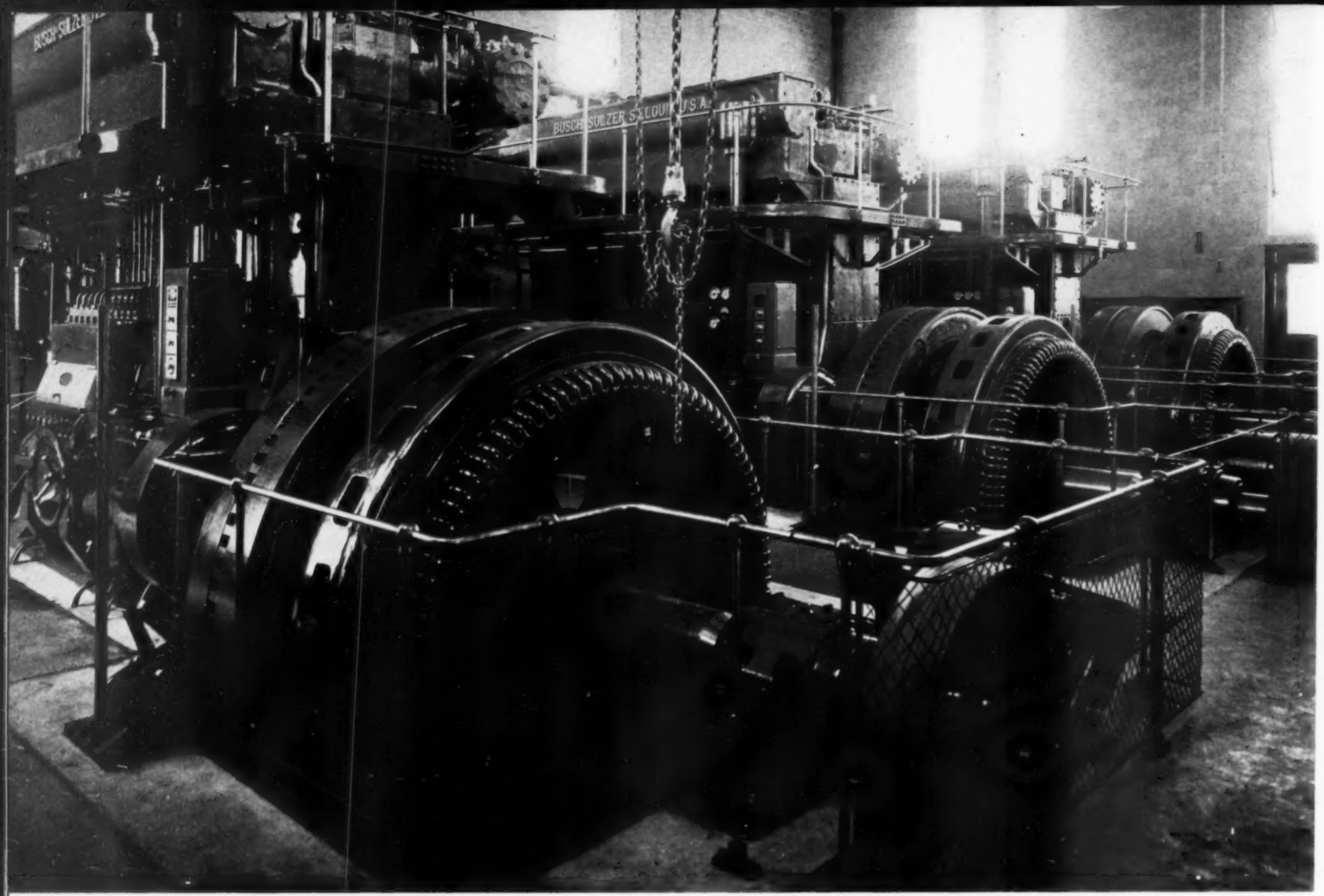


When the present remodelling and building program is completed, the Thomas Laughlin plant will look like this.

Production in this interesting plant is being maintained even with new construction and remodeling going forward on every hand. Continuous power is doubly essential under these conditions. Electric lines are being relocated, production equipment is being rearranged while normal operations are maintained. Power requirements for this type of plant may be appreciated when one visualizes the stock cutting, heating, drop forging, heat treating and finishing operations involved in the manufacture of a large line of marine and industrial hardware. The Thomas Laughlin Company has been in business a long, long time and they are preparing for another long stretch with streamlined personnel direction, latest production methods, plant, equipment, and dependable, controllable Diesel generated power.

Close-up showing compact built-in engine accessories, including air filter, governor, heat exchanger, fuel oil filter and scavenging pump housing.





Engine room view showing the three 625 hp. Busch-Sulzer Diesel generating units now serving 1,000 farmers in three Illinois Counties. Present plans call for eventual service to 3,000 members in eight counties.

Below, rear view of plant showing exhaust stacks center, Marley cooling tower in the foreground, and fuel storage tanks right.

WINCHESTER, ILLINOIS

R.E.A. Project

By S. R. FARIS* *and* H. G. BRYAN†

THE aims and service to which this Diesel electric generating plant at Winchester, Illinois, are dedicated are clearly set forth in the wording of a plaque at the entrance to the building:

"To advance the position of agriculture, to enrich the life of the community, to free men and women from the heavy drudgery of the home and farm. This generating plant was erected in cooperation with their Federal Government by farmers of the neighborhood to whom it supplies the limitless service of electricity."

The organization of farmers sponsoring this project is known as The Illinois Rural Electric

*Chief Engineer.
†Supervisor.

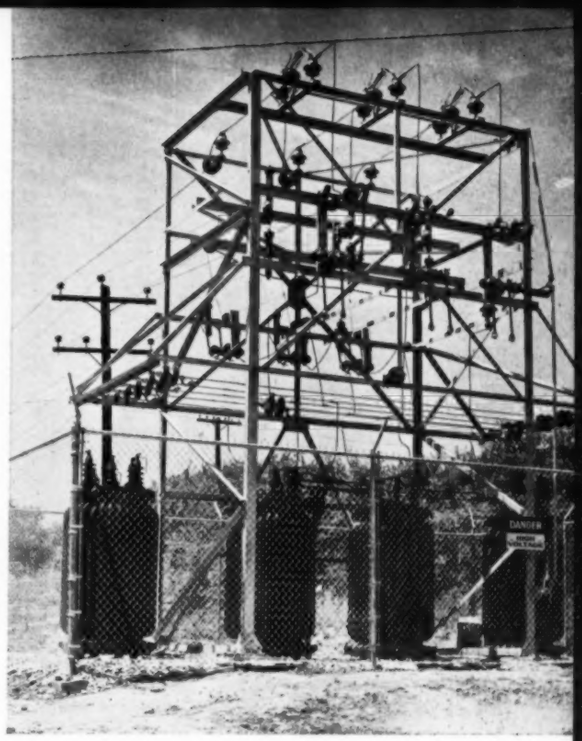
Company, of which the president of the Board of Directors is Mr. J. Wes Smith, and it is the only Rural Electrification Cooperative in Illinois with it own generating plant. The money for building the plant and the system was loaned by the Rural Electrification Administration. The project, consisting of 606 miles of energized lines, 440 miles of lines under new construction is under the management of Mr. H. G. Bryan, R. E. A. Supervisor, Washington, D. C.

The plant contains three 625 hp. generating units which are housed in a new brick and concrete building located four miles south of Winchester, Ill., on Route 106. The main part of the building is the generating room, in which the engines are placed parallel to each other. Across the front of the building is an office, work shop, and locker room. Directly behind the locker room and running lengthwise of the building is the switchgear and switchboard. Mounted on the wall above the aft end of each engine are the 300 gallon fuel oil day tanks. Just below and to the right of the day tanks the exhaust pipes pass out of the building into an exhaust chamber, through this chamber, and out the top to the atmosphere.

There is a basement under the entire building, along the rear wall of which are arranged the lube oil transfer pump, five motor-driven cooling water pumps, the heating system water circulating pump, cooling water pipe, and control valves. Along the north wall are the three starting-air tanks, motor-driven air compressor, and a gasoline engine-driven air compressor. On the south side a 5,000-gallon fuel oil storage tank, fuel oil centrifuge, transfer pump, fuel oil meters, sanitary water storage tank, water softener, lubricating oil purifying system and tanks are located. Directly below the switchboard are the three field rheostats connected to hand controls on the switchboard by chain drives. To the left of the rheostats is an auxiliary gasoline engine-driven light plant which can be started by a switch on the switchboard. The front part of the basement is taken up by a storage room for lubricating oil, spare parts, and transmission line material. The engine lubricating oil sump tanks are located along the north side of each engine foundation, while on the south side of the foundations the lubricating oil coolers and twin Cuno-type fuel oil filters are located.

Two 25,000-gallon fuel oil storage tanks, a step-up transformer sub-station, a Marley cooling tower, one water well with motor-driven pump, one water well with a gasoline engine-driven pump are located outside of the building. The two wells are located one-quarter mile from the plant and controlled by switches at the plant.

At the rear of the building, between two of the exhaust chambers, is a large concrete soft water reservoir from which the jacket cooling water is taken. Before placing the water in the reservoir, it is run through a water softener. Rain water from the roof of the building also drains into this reservoir and usually keeps the water at proper level. An overflow at the top of the reservoir drains into a sewer and takes care of any over-supply of water, due to heavy rainfall. The jacket cooling water is taken from the reservoir by the circulating water pumps, circulated through coils in the cooling tower, through the engines, and discharged back to the reservoir. The cooling tower make-up is supplied by the well and kept at required level



Sub-station transformer bank located adjacent to the generating plant.

by a float switch controlling the motor at the well.

Due to difficulty encountered in securing ample water supply, the generating plant had to be built some distance from a railroad. This necessitates delivering fuel supply from tank-trucks into the two 25,000-gallon above-ground storage tanks. The fuel oil transfer pump in the basement transfers the fuel oil from the storage tanks to the day tanks, through a meter. In case a shipment of dirty fuel oil is received, it may be by-passed through a Gould Hydroil Centrifuge to the 5,000-gallon clean-oil storage

Exterior view showing arrangement of fuel storage tanks and sub-station.

tank in basement, where it can be picked up by the transfer pump. From the day tanks the fuel flows through a pump driven by the crankshaft of the engine by gears, through the twin Cuno-type strainers to the fuel pumps of the engines.

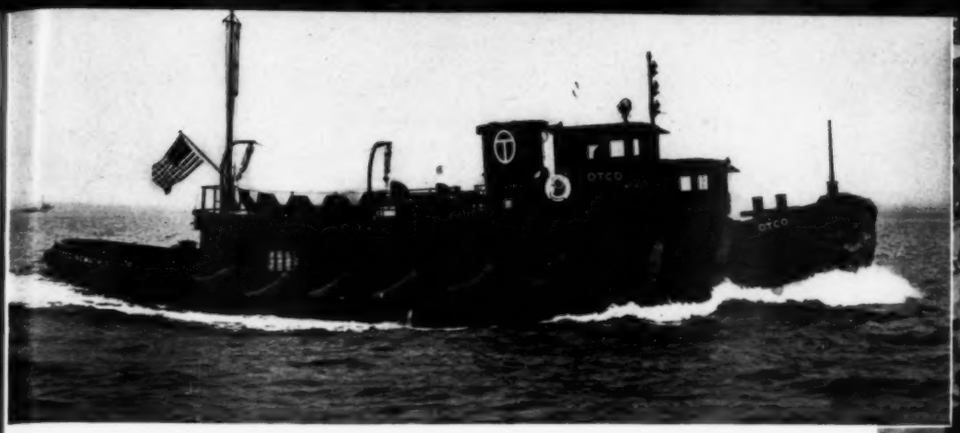
The generating capacity of the plant is 1,200 kw. There are three 625 hp. 5 cylinder, 4 cycle, type DB, Busch-Sulzer Diesel engines, turning at 257 rpm. These are direct-connected to three Elliott three-phase, 60 cycle, 2,500 volt, 500 K.V.A. generators. The exciters are also Elliott 15 K.V.A., 125 volt, driven by "V" belts.

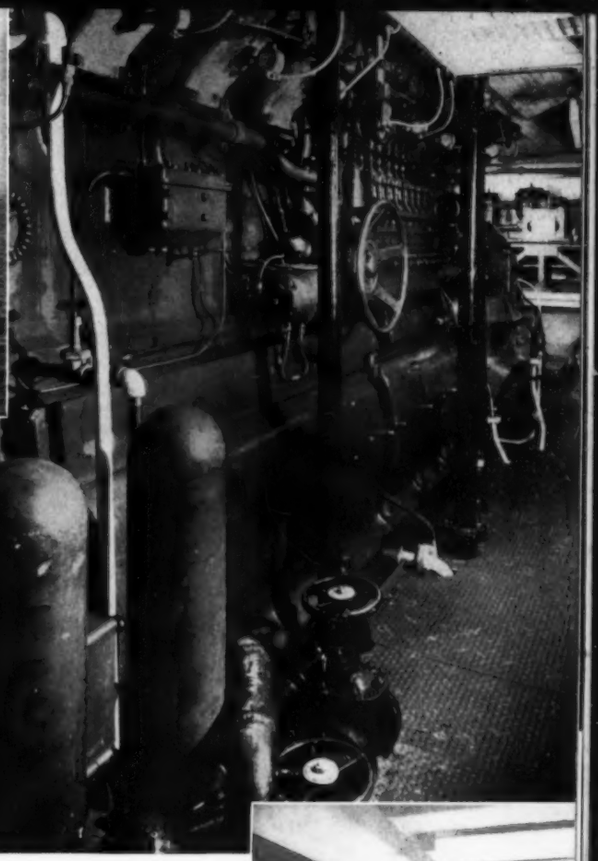
The engines are equipped with Woodward governors and American Air Filters supply the engines with clean air. A panel with lube oil pressure gauges, fuel oil pressure gauges, water pressure gauge, and an Alnor Exhaust Temperature Pyrometer is mounted on the operating side of each engine, directly above the starting and stopping control gear. Each engine is equipped with an over-speed cut-out governor, low pressure lubricating oil shut-down device, low pressure and high temperature alarms on water and lubricating oil.

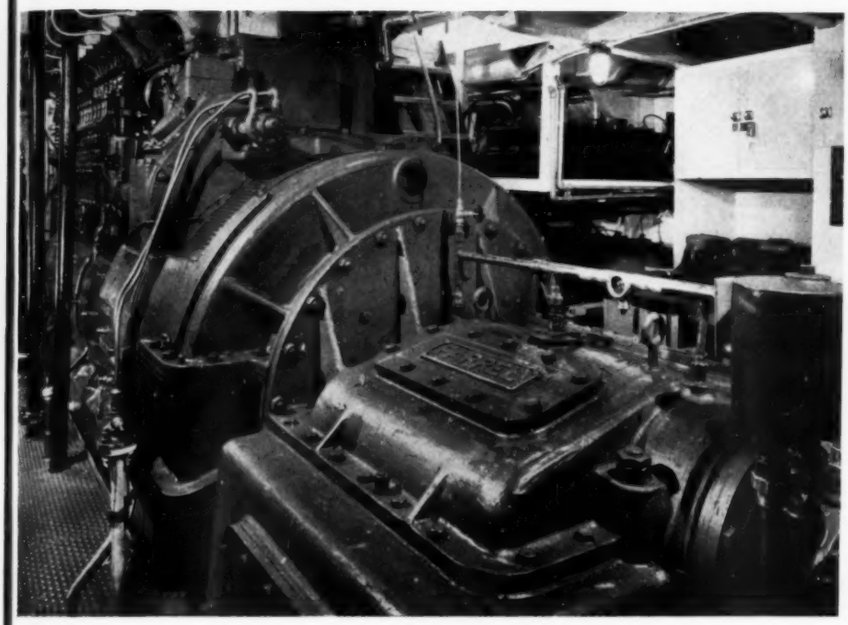
View of the seven panel switchboard showing totalizing instruments on swinging panel at extreme left and push button controls for plant auxiliaries at right.

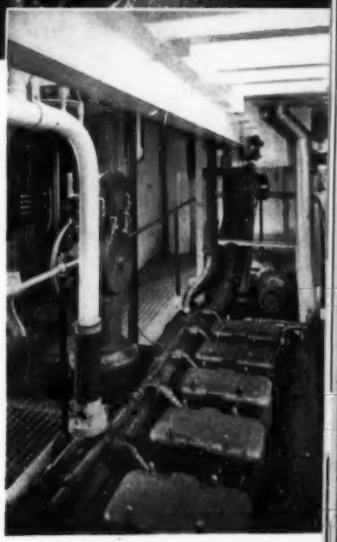
The station power transformer bank consists of three 25 K.V.A., and one 7.5 K.V.A. Westinghouse oil-cooled type, 2,400 volt by 120/240 volt transformers. The latter is used on the station lighting circuit. The sub-station is equipped with four Kuhlman oil-cooled transformers type D.I.S.C., high volts 13,280/23,000, Y-KVA. 267; tertiary volts 7,200/12,500 Y-KVA. 66; low volts 2,500-KVA. 333.

This project was designed and built under the supervision of Caldwell Engineering Company, of Jacksonville, Ill., subject to the approval of the Rural Electrification Administration Engineering Division. Contractors for the project were Busch-Sulzer Brothers Diesel Engine Co., St. Louis, Mo.; A. F. Krall & Co., Decatur, Ill.; and A. S. Schulman Electric Co., Chicago, Ill. Attorneys for the project were Hon. Judge James M. Barnes, Jacksonville, Ill., and Weaver & Jenkins, Pittsfield, Ill.









Note compact lines of tug "Otco" above, also McIntosh & Seymour engine with self-contained accessories. At left—Farrel-Birmingham speed reduction gear, and right—general view showing control station.

DIESEL TUG "OTCO"

By GEORGE D. CROSSLEY

IN September, 1938, the Oil Transfer Company of New York put into service a new all-welded Diesel tug with all facilities for coastwise, harbor and barge canal service. The new tug, christened the *Otco,* was designed by H. N. Whittelsey, naval architect, and built by Jakobson & Peterson of Brooklyn. The *Otco* measures overall length 84 ft. 6 in., breadth 23 ft., draft in coastwise service 10 ft. 6 in. and in canal service 9 ft. to allow for shallow water.

To provide the maximum of propulsion power within restricted space limitations, a 720 hp. McIntosh & Seymour Diesel engine with 8 cylinders, 12½ in. bore by 13 in. stroke, 600 rpm., of the 4-cycle type was selected. The engine lube oil is reclaimed in a Hilco reclaiming system, operating as part of the high pressure lubrication system. An Alnor pyrometer gives a constant check on combustion, a Nugent filter cleans the fuel oil, and a Sentinel filter handles the lubricating oil. A Maxim exhaust silencer and spark arrestor is mounted vertically in the stack.

The propeller is driven at a speed of 120 rpm. through a Farrel-Birmingham 5:1 ratio speed reduction gear. Engine rpm. is indicated by a Weston tachometer. V-belted to the forward end of the engine is a 10 kw. Electro-Dynamic generator with an Exide battery floating on the line to act as a current reservoir.

There is an auxiliary set comprised of a Superior Diesel engine, 4½ in. bore by 5¾ in. stroke, 31 hp. 4-cylinder, direct-connected to a 20 kw., 140 volt DC, 900 rpm., Electro-Dynamic generator. The generator shaft is extended through to drive a Waterous 160 gal. per minute pump through a Dodge gear tooth type cut-off coupling. The engine crankshaft is extended through the forward end of the crankcase to drive a 40 cu. ft. 2-stage Gardner-Denver air compressor, also through a Dodge gear tooth cut-off coupling.

The steering engine is American Engineering electro-hydraulic type with dual controls.

In all respects the *Otco* satisfies the requirements of operation at sea, in the harbor, and on the canal. It is unusually compact, sturdy, powerful, and complete in every detail.

SEABOARD'S SILVE E

By WILL H. FULLERTO

THE Seaboard Railway has again pioneered in the transportation field by offering its *Silver Meteor,* the first streamlined, stainless steel train ever to be placed in the New York-Florida service. This seven car reserved seat coach train is powered by a 2,000 hp. Diesel-electric locomotive and inaugurated the first all electric-powered coach service between New York and both coasts of Florida on February 2.

The *Silver Meteor* has been created as the Seaboard Railway's contribution to the most modern style of rail transportation. Constructed of gleaming stainless steel and containing the most modern and luxurious appointments for comfort and convenience of its passengers, the *Silver Meteor* represents the last achievement of designers.

Built by the Electro-Motive Corporation, the locomotive is a 2,000 hp. unit, identical in all essential details to the "A" unit built by the same company for the Seaboard *Orange Blossom Special.* This power plant consists of two 1,000 hp. General Motors 12-cylinder, two cycle Diesel engines controlled simultaneously from one throttle. The engine is a "V" type 8½ in. bore by 10 in. stroke, with a seven bearing crankshaft. The connecting rods are drop forged and needle bearings carry the piston pins in aluminum pistons. Lube oil, water, and scavenging pumps are built in. Each Diesel engine drives a 600 volt DC generator supplying power to the 450 hp. traction motors mounted on the trucks under each power plant. Electro-Motive Corporation supplied the electrical equipment. Measuring 70 ft. 4 in. long over the coupling pulling faces the locomotive weighs 315,700 lbs. This weight is almost equally distributed on two six-wheel trucks both of which are geared to traction motors mounted on the trucks.

Train speed is controlled by the main throttle with an electro-pneumatic relay to the engine governors. A reverse lever and brake handle complete the train control equipment. Engine performance checking equipment, consisting of lubricating oil and fuel oil gauges and speed indicator, is installed at local control stations.

This truly remarkable train provides all of the luxuries and conveniences found on extra-fare trains at ordinary coach fares. The design and appointment of each unit of the seven car train has been thought out to give the maximum of passenger comfort over long distances at high speeds. The coaches are of stainless steel, one piece welded construction by the Shotweld method, built by the Edward G. Budd Mfg. Co., combining light weight with great strength and quietness. Air-conditioning equipment, supplied by Frigidaire Division of General Motors Corporation, with air filters by Air-Maze Corporation, and Multi-Vent panels by Burgess Battery Company, insure clean, comfortable air conditions for passengers, in all kinds of weather.

Each of the seven cars is 84 ft. 8 in. coupled. Each coach is decorated with its own distinctive and contrasting color scheme. The first car of the train directly behind the Diesel locomotive is a combination of baggage and passenger car. The second car provides reclining seat accommodations for sixty passengers, as well as men's and women's lounges. The third car of the train is a combination chair-tavern car. The chair section accommodates thirty passengers forward with the tavern section aft and between the two sections is a hostess-nurse's room. The fourth car is the diner with accommodations for forty-eight passengers. The fifth and sixth cars are sixty-passenger reclining-chair cars. The last car of the train has a forty-eight passenger chair section forward, and a rounded streamline observation section in the rear.

The exterior of the *Silver Meteor* presents a solid tube-like appearance. Rubber diaphrams

METEOR

between the cars are stretched taut to continue the streamlining throughout the length of this gleaming stainless steel train.

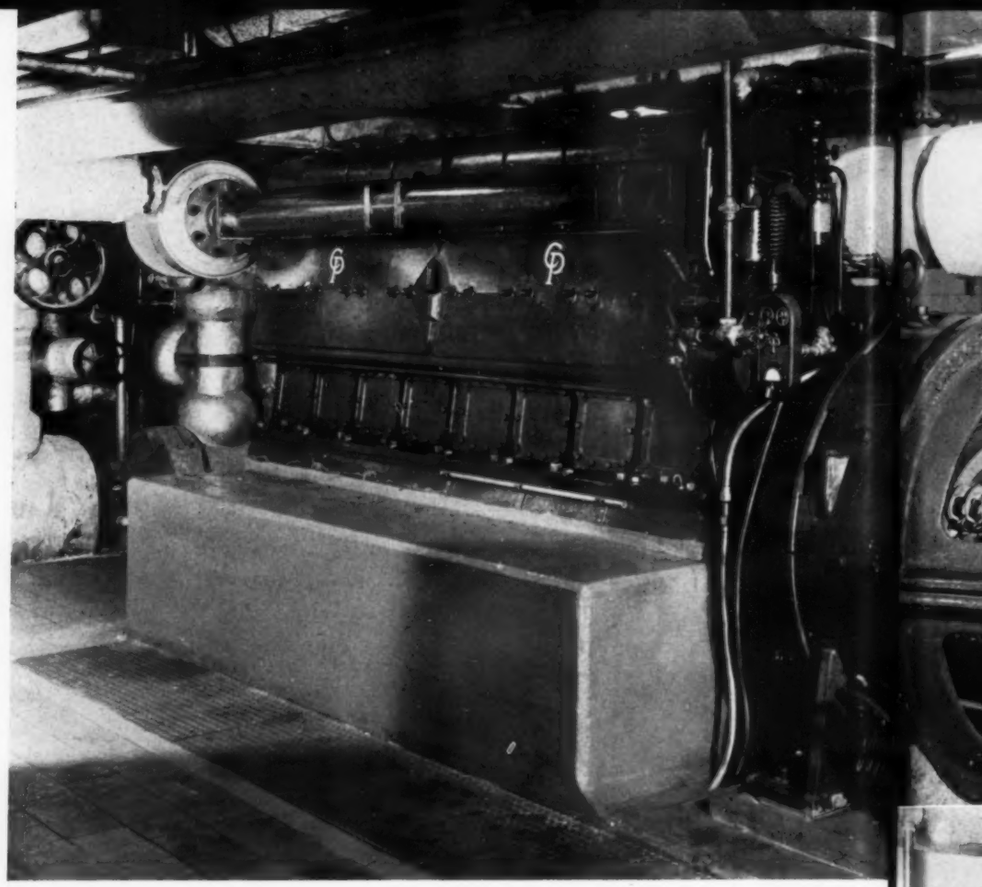
During the construction, the cars were completely insulated. The floors are built up from a corrugated stainless steel base with cork stripping placed in the corrugations over which a layer of mastic and cork is placed. The walls and ceiling contain a thick blanket of rockwool to provide insulation against both heat and cold.

The *Silver Meteor* is scheduled for a round trip every three days on alternate runs between New York and Miami, and New York and St. Petersburg, Florida. On the Miami run, a distance of 1,389 miles, is covered in 26½ hours going south while 27 hours is required for the trip north. On the run from New York to St. Petersburg, a distance of 1,247 miles, the scheduled time is 23¾ hours and 25 hours five minutes from St. Petersburg to New York. Up to the time of writing the 2,000 hp. Diesel locomotive has been satisfactorily maintaining schedules. With the *Orange Blossom Special* and the *Silver Meteor* covering the Florida runs regularly, the Seaboard Railway has ample opportunity to demonstrate the economy and reliability of Diesel motive power, as well as the passenger pulling power of ultra-modern equipment.

Top left — The "Train of Tomorrow" is christened by "The Girl of Tomorrow," representing the 1939 World's Fair. Above — The luxurious "Silver Meteor" Tavern. Left — A corner of a sixty-passenger chair car. Note wide full vision window and photograph mural decoration.

NEW YORK PUBLIC LIBRARY

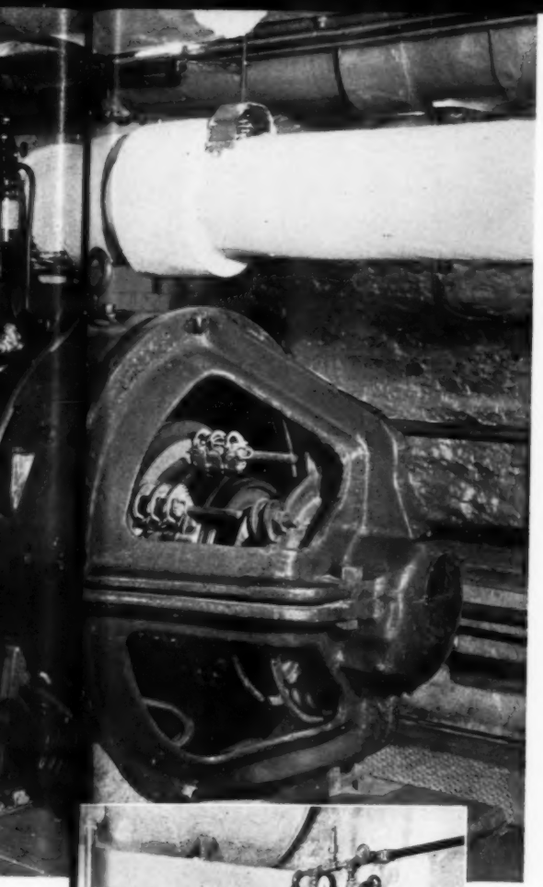
By OTIS A. SIBLEY



SINCE its official opening in May, 1911, the New York Public Library has generated its own steam for heating and electrical power. Because light is so important to a building of this type devoted exclusively to serving the public, the entire plant was installed in duplicate. In addition, connection to the local utility was maintained to eliminate the slightest chance of power failure. This emergency breakdown service was also used from time to time during the past twenty-eight years during plant repairs, and constituted an operating charge which could be eliminated only by substituting an equally dependable source of power available at a saving in expense. This, primarily, was the reason for considering the installation of a Diesel engine. As such an investigation progressed it became increasingly evident that considerable additional savings could be effected with a Diesel in making possible a more efficient load and heat balance with the existing steam engines. The sound reasoning of Superintendent John H. Fedeler and Chief Operating Engineer Earl I. Gates, both of the Library staff, resulted in the present addition to the plant of a Chicago-Pneumatic Diesel which was installed under the supervision of the Library operating engineering staff according to plans and specifications prepared by Edwin A. Kingsley, Consulting Engineer, retained by the Petroleum Heat & Power Company, general contractors for the installation. The Diesel is a 250 hp., 8 cylinder, 4 cycle unit directly connected to a 250 volt Crocker-Wheeler generator and operates at 600 rpm. Naturally, the Library would not tolerate the slightest noise or vibration transmission to the building structure and the successful solution to the problem of isolating the normal operating frequencies is of interest. The engine and generator were integrally mounted on a steel and concrete sub-base which extends three feet below floor level. This foundation, in turn, is resiliently mounted on special Korfund Panel Seismo-Dampers built to specifications of the Consulting Engineer. These anti-vibration units consist of natural cork blocks, the size of which was determined by the load, arranged in sheet steel panels which fit together to cover the bottom of the pit. As further protection, pockets in the concrete base were left to accommodate Korfund steel spring isolators should subsequent operation prove them desirable. Access trenches on each side of the engine are covered by steel floor plating. All connections to the Diesel are isolated by Atlantic flexible metal hose. With Burgess silencers on both intake and exhaust manifolds, the isolation of vibration and noise was complete and satisfactory. Other auxiliary equipment includes Viking Safety Controls on lubricating oil and cooling water supply lines and a Quincy motor-driven compressor for starting air requirements.

Typical view of this type of Chicago Pneumatic Diesel engine with valve covers and side plates removed. These engines are essentially dust-proof and oil-proof, yet readily accessible.

Although the reason for installing the Diesel was primarily to eliminate expensive stand-by service, it became increasingly evident that this saving was only a fraction of the potential total. Heat recovery from the jacket cooling water and utilizing the engine to effect a more economical power balance with the steam units make it advisable to operate the Diesel at times during the day in winter and on a twenty-four hour basis in summer according to present indications. Cooling water comes from the city mains at an average temperature of 55 degrees F. and is discharged from the engine at approximately 140 degrees into a surge tank. From there it is diverted to boiler feed through a gravity flow or is discharged into the building hot water distribution service mains by means



Quincy compressor in the Library installation.

of a Goulds centrifugal pump, depending upon the season. In either event, however, the saving is substantial in addition to the low cost of power actually delivered by the Diesel. While the high thermal efficiency of this type engine is now generally recognized, it is not so well known that existing steam plant efficiencies can be improved by balancing the load with a Diesel. This is particularly true of course in installations of this type when full use of exhaust steam cannot be made.

Another lesser recognized advantage of the modern Diesel engine is its ability to fit into odd corners or other waste spaces due to its small size in relation to power delivered. This is particularly important in making additions to existing plants such as the Library since it eliminates the necessity of disturbing or moving other units.

While it is too soon to have complete operating records on fuel economy and maintenance, it is evident from present indications that the new engine will amortize its initial cost out of savings in a reasonably short period of time. The Library will then have dependable power for any emergency without the previous annual charge and also the continued benefits of numerous economies as previously outlined. It is important to note, further, that the factor of safety is now more than 300 per cent greater than the previous 50 kw. service.

Aside from the air compressor and storage tank which provides a conservative minimum of fifteen starts without recharging, the engine room is free from auxiliary equipment which is all engine-mounted. Clean fuel and lubricating oil is maintained by Nugent and Cuno filters, respectively. Engine speed is closely regulated by a Pickering governor and individual cylinder temperature readings are instantly available by means of an eight point Alnor pyrometer. Once started and "on the line," the Diesel requires little or no operating supervision except customary routine inspection.

All the equipment and auxiliaries for the Diesel generating plant were furnished to the Library by the Petroleum Heat and Power Company, Inc. The installation of the unit, including the foundation, isolation, piping and electrical work, was under the direct supervision of Mr. Gates, Chief Operating Engineer of the Library, and Mr. Knoll of Edwin A. Kingsley's office, the Designing Engineer.

With a Diesel engine now operating in the New York Public Library at the corner of Fifth Avenue and 42nd Street, New York City, no one should hesitate about adopting this most economical form of power wherever it may be of benefit to him.

Typical General Motors Diesel truck using the Series 71 General Motors Diesel engine.

DIESELS WILL DISPLACE GASOLINE ENGINES, SAYS COLONEL GEORGE A. GREEN

Vice President in Charge of Engineering, General Motors Truck & Coach Division, Yellow Truck & Coach Mfg. Co.

MUCH has been said in recent years — and much will be said in the important months to come — concerning the advantages of the Diesel engine as compared with the gasoline engine. Many of the points brought up by the debaters of the respective merits of both types are moot points, which are far beyond the ken of this humble experimenter. I would not attempt to decide them, nor do I think they should be decided at this time.

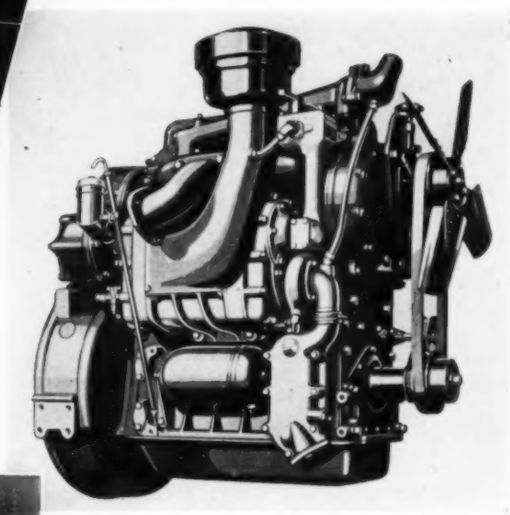
Rather, I believe the leaders in the vast field of transportation should look upon the facts alone, the practical aspects, and conclude — as they must ultimately — that the Diesel engine is not a competitor of the gasoline engine, but rather a mechanism which will replace it in many fields as surely as the gasoline engine replaced Old Dobbin.

With this in mind, the writer herewith undertakes to present, as simply and concisely as possible, the advantages of the Diesel engine and its importance from an economic standpoint.

Briefly stated, the major advantages of the Diesel as compared with the gasoline engine are:

First: Due to the much higher compression and also the constant compression ratio, the econ-

These two gentlemen are impressed with the quietness and smoothness of this 4-cylinder 2-cycle General Motors Diesel engine which is showing 110 hp. on the dynamometer at this reading.



The General Motors 2-cycle 3-cylinder Diesel engine, as used in General Motors trucks and buses, is compact, light, and smooth.

omy is inherently superior, particularly at part loads.

Second: At present, and for some time to come, the cost of the fuel is less.

Third: The fuel is relatively fireproof and can be stored and handled without special precautions.

Fourth: The exhaust is almost completely free from carbon monoxide; one-fourth of one per cent is the highest content ever found, while a gasoline engine in good condition emits about one per cent of carbon monoxide when idling.

Fifth: The Diesel engine is more reliable than the gasoline engine.

Regarding the Diesel from an economic standpoint, if any really worthwhile reduction in operating expense is to be accomplished one must attack the major items — and fuel is certainly the major item. Naturally the labor cost per mile to maintain a fleet of units will vary dependent upon a number of factors. But, considering an average condition, the fuel cost per mile is certainly at least equal to the labor cost per mile to maintain the vehicles. No matter what is done mechanically, it is hard to conceive of our being able to cut the labor bill in half, yet an economy of this magnitude might be accomplished as a result of the standardization of the Diesel engine.

In most states Diesel fuel is taxed; in general, the tax is lower than that on gasoline, but eventually it is only logical to suppose there will be little if any difference in the cost of gasoline and Diesel oil. But, even assuming a widespread use of the Diesel engine for all commercial vehicles, including trucks and coaches, the total usage of Diesel fuel will only represent a fraction of the total gasoline usage for the automobile, which means that we shall probably have the advantages of cheaper Diesel fuel with us for a long time to come.

To arrive at an estimate of possible money saving due to the lower consumption of the Diesel as compared with the gasoline engine, as an average considering vehicles of similar weight and performance characteristics, where six miles per gallon is obtained with the gasoline engine, ten miles per gallon may be expected for the Diesel.

Until such time as Diesel engines are produced in much larger quantities, their cost must necessarily be considerably higher than that of corresponding gasoline engines. Obviously, one of the Diesel's most interesting possibilities is its ability to save money for the operator. To determine if the saving is sufficiently great to justify the employment of a Diesel engine it is simply necessary to ascertain the time required to amortize the difference in cost between the Diesel and gasoline engined equipment based, of course, on the Diesel's decreased fuel consumption and taking into consideration the mileage, the cost of the fuel, and the six-ten fuel consumption ratio.

In my opinion, there is a place for both the gasoline and Diesel engines. However, I think the sphere of the gasoline engine is rapidly narrowing, in short, that the time has arrived when every prospective buyer should carefully analyze his particular situation so that on a basis of simple mathematics he can reach a determination as to the correct type of engine to suit his individual needs.

DAIRYLEA TRUCK SAVES 45%

By WILBUR W. YOUNG

THE Dairymen's League Cooperative Association of New York put this big Mack tractor and Budd tank trailer in service October 22, 1938. The tractor is powered with a Mack-Lanova ED Diesel engine and hauls a gross load of 54,000 pounds with a pay load of 30,100 pounds which is 15,050 quarts of milk.

According to C. F. Hawes, Traffic Manager of Dairymen's League, the most difficult part of the territory in which they operate is through the Catskill Mountains into New York City. The Diesel unit was, therefore, placed on this run in order to secure a complete test of its ability under severe operating conditions, in comparison with gasoline powered units hauling the same loads over the same route.

The Diesel unit has covered 37,000 miles to date and is credited with a fuel saving of 36.5 per cent by volume over the gasoline tractor and an actual fuel cost reduction amounting to 45 per cent of that used in the gasoline unit. Performance of the Diesel unit on hills is admittedly better than that of the gasoline tractor because of the well-known lugging ability of Diesel engines. Fewer gear changes result in fuel economy and reduce wear and tear on equipment.

When the Dairymen's League was preparing to put this Mack-Lanova powered tractor into service, they seriously considered carrying a blowtorch in the cab to assist in cold starting. It was found, however, that the engine started readily at all times without artificial warming.

There has been no difficulty with so-called smoke nuisance, as there is only a slight odor not exceeding that from gasoline engines of comparable size. It is believed that the only reason the odor from the Diesel truck is noticeable at all, is because it is a different odor than that of burning gasoline with which we are more familiar.

It has been found that the Diesel truck is much easier on the braking system. Due to the higher compression and the fuel governor, this Diesel engine has greater braking power in ordinary deceleration and going down hills than the gasoline engine.

While the Mack-Lanova engined unit is expected to maintain closer schedules in comparison with the gasoline unit, this has not been definitely worked out due to bad weather and road conditions which have prevailed in the Catskill territory since last October.

The Mack Diesel engine is a six-cylinder, 4-cycle power plant of 4⅛ in. bore x 5¾ in. stroke, 519 cu. in. displacement, developing 131

Mack-Lanova six-cylinder 4-Diesel engine, bore 4⅜ in., 5¾ in., 519 cu. in. displace-developing 131 hp. at 1,200

hp. at 1,200 rpm. The bmep is 110 lbs. and maximum torque is 381 ft.-lbs. Two separate castings of three heads each make up the cylinder head assembly. The cylinder block is cast integral with the crankcase for strength and rigidity. The heavy crankshaft is counterbalanced with twelve counterweights forged integral and is mounted in seven 3½ in. main bearings. The connecting rod journals are 3 in. diameter. Pistons are T-slot camground aluminum alloy. Full floating piston pins with telescoping aluminum button retainers are ground to spherical segments on the ends to conform with the arc of the cylinder bore.

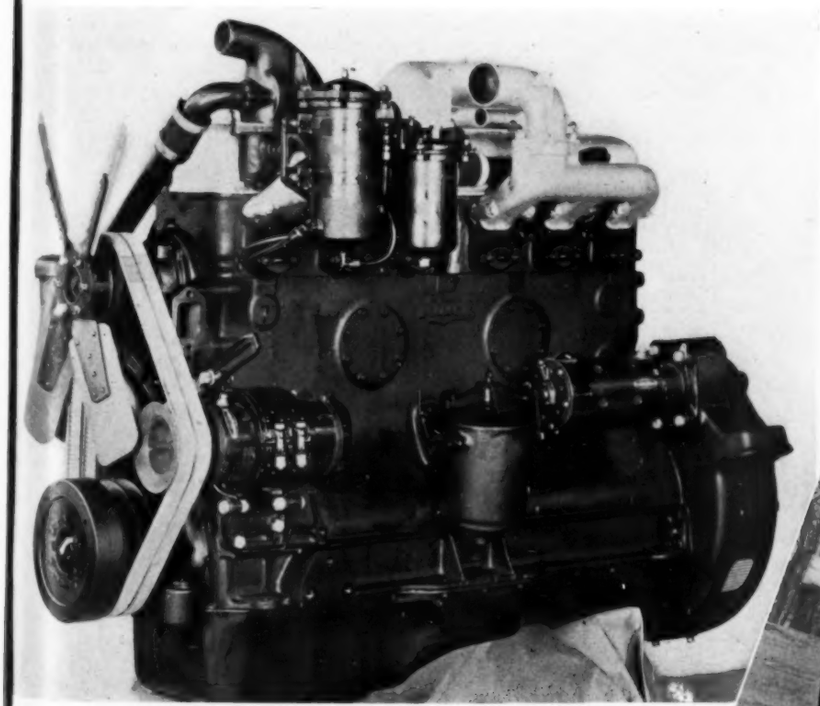
The American Bosch fuel injection system consists of pumps and pintle type nozzles. The injection pumps are factory-timed and sealed against tampering. Fuel is supplied to the injection pumps by a Bosch transfer pump, the fuel being filtered once ahead of the transfer pump, and twice between the transfer pump and the injection system. This insures delivery of grit free fuel to the nozzles.

The Mack-Lanova Diesel engine uses the Lanova energy cell combustion system. The characteristics of this system are that it produces high power per cubic inch of displacement with moderate peak pressures, low bearing pressures, low fuel injection pressures, and low compression pressures. It makes for smooth, responsive, flexible operation of the engine. The Lanova combustion head engine starts quickly in cold weather, idles smoothly, and is clean burning.

The system of temperature control, which is distinctive in all Mack engines, is particularly advantageous to the operation of this Diesel engine. To secure uniform temperature throughout the cylinder block a portion of the incoming water is directed upward and reaches the cylinder heads adjacent to the exhaust valve seats. Part of the water is forced down through the cylinder jackets and then rises to the heads through seperate passages. The rate of flow is regulated in proportion to the amount of heat absorbed.

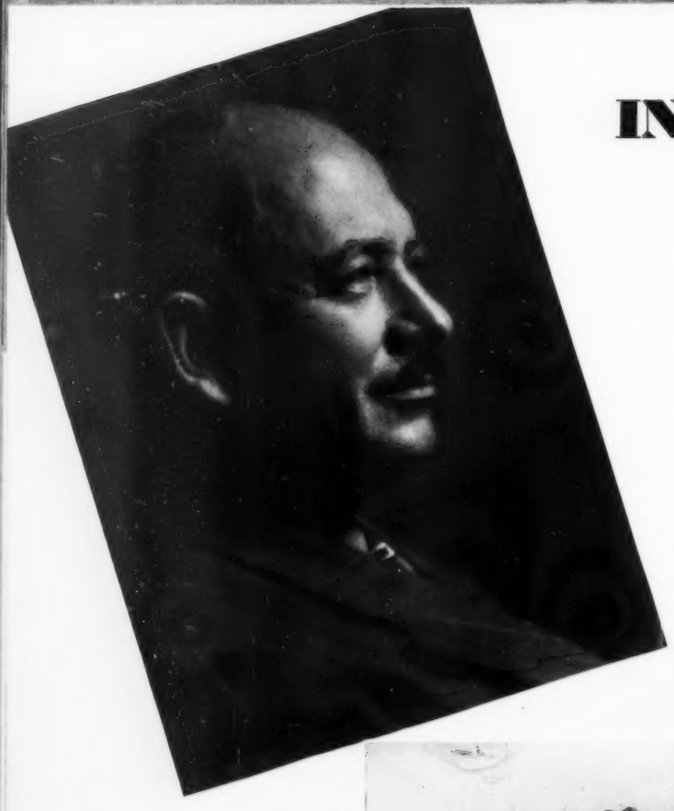
Thermostatic control of the circulating water in the Mack cooling system allows circulation of water within the radiator at all times, thus eliminating danger of freezing when starting cold. The thermostatic valves, however, prevent circulation of jacket water until the engine has been thoroughly warmed up.

This first Mack-Lanova Diesel engine in Dairylea service is performing up to expectations. A recent inspection of all engine parts satisfied the operators that they can expect dependable and economical service from this unit well past the 100,000 mile mark.



The Dairymen's League Co-Operative Association's Mack-Lanova powered Diesel tractor hauls a gross load of 54,000 lbs. and a pay load of 30,100 lbs.

An International 149 in. wheelbase Cummins Diesel-powered truck in use in a gasoline hauling fleet in Ohio.



INDUSTRY WILL SHOW 100% INCREASE, SAYS PARIS E. LETSINGER

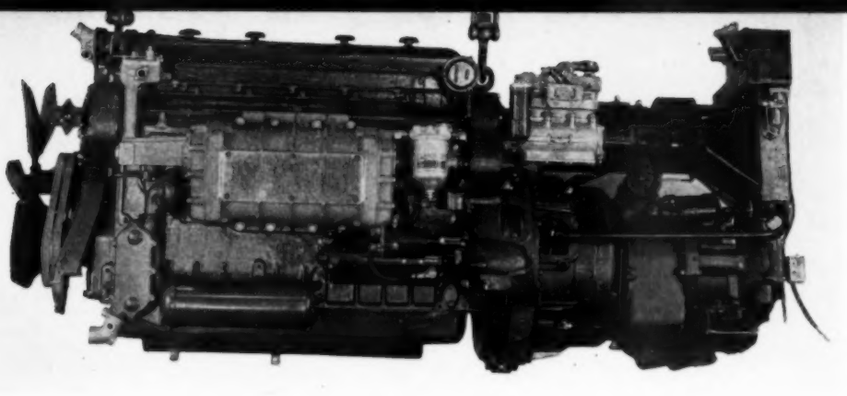
Vice President, Cummins Engine Company

"DURING the past six years the Diesel has steadily gained recognition, both through the general acceptance by the operators as well as the truck manufacturers. During this period, the Diesel has proven its economy and dependability and has won a definite position in the industry by job test evidence in long hauls, short hauls, and congested traffic conditions.

"The Diesel in most cases is lighter per foot pound of torque than the automotive gas engine of equal cylinder size, and due to the larger range of usable torque, this has made the Diesel the preferred power in the construction field, and has made it possible to reduce general maintenance expense of the Diesel.

"Now that the nation's largest truck manufacturers are all offering Diesel powered trucks we see a growing demand for Diesel engines, for short haul as well as long distance hauling, and we feel the Industry will show better than 100 per cent increase in demand in 1939 over 1938, and predict that 1940 will see better than 25,000 Diesel powered motor trucks built and sold."

Available Diesel tractor powered with a six-cylinder Model HB Cummins Diesel. This tractor hauls two trailers fitted with gasoline tanks with a total capacity of 10,000 gal. and a total loaded weight of 100,000 lbs. at 40 mph.



Six-cylinder Series 71 General Motors Diesel engine equipped with hydraulic drive.

DIESEL TRUCK MARKET IS VERY SPIRITED, SAYS J. P. LITTLE

Vice President, Directing Sales for General Motors Truck & Coach Division, Yellow Truck & Coach Mfg. Company

ACCORDING to sales figures released by J. P. Little, Vice President directing sales for General Motors Truck and Coach Division, Yellow Truck and Coach Manufacturing Company, there is widespread interest in GMC Diesel trucks as a transportation medium, and a surprising number of orders from many varied vocations.

Both owner-driver operators and fleet buyers have placed orders for GMC Diesel trucks, many to be commissioned for service in remote parts of the country, the orders for which were secured by regularly franchised GMC dealers in the smaller towns. "This in itself is a healthy sign," Mr. Little stated. "There is a very spirited market for Diesels among users of medium and heavy duty trucks," he added.

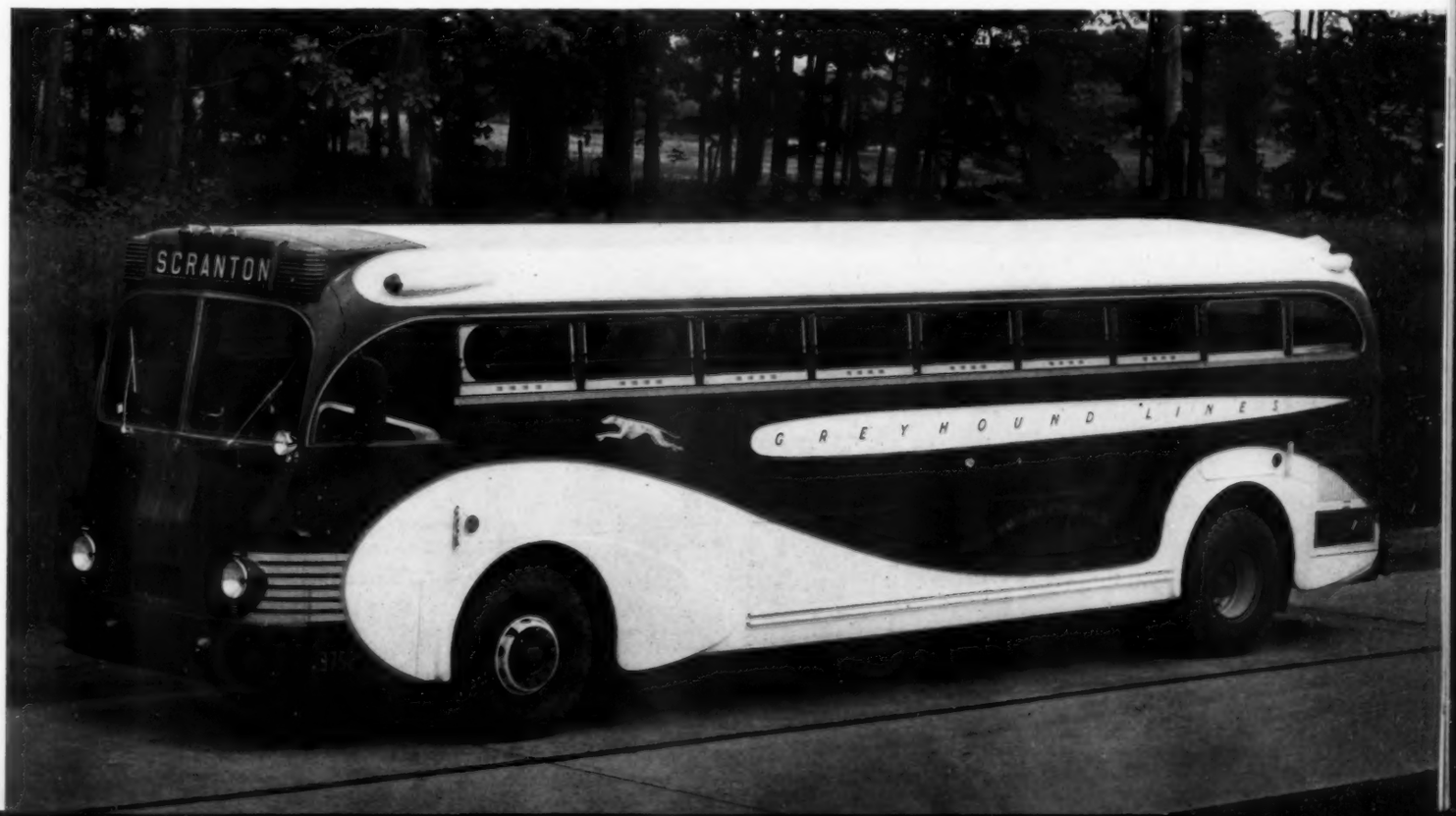
Diesel trucks took their place in the GMC line for the first time with the introduction of 1939 GMC models at the National Truck Show in New York City last November. Since that time, Mr. Little said, GMC Diesel sales have been made in the company's four regions throughout the United States and by the national fleet department of the home office.

Included among recent purchasers of General Motors Diesel Trucks are: Standard Oil of New Jersey; Cities Service Oil Company; Brady Brothers, Boston; Shoreline Express, Inc., Boston; Casting Transportation Company, Chicago; White Star Refining Company; Crown Oil Company, Denver; Ruby Stowell, Long Branch, Cal.; Fred Lundblade, San Francisco; Acme Freight, Jacksonville, Fla.; Rockmore Gravel Company, Montgomery, Ala.; A. S. Herlong, Orlando, Fla.; Dalby Motor Freight Lines, Lubbock, Tex.

Swift & Company, Chicago; Pure Oil Company, c/o J. B. Moore, Detroit; Fullerton Transportation Co., New York; Michigan State Highway Department; U. S. Trucking Company, Detroit; Reliable Cartage Company, Grand Rapids, Mich.; Bert Gooley, Saginaw, Mich.; Buckingham Transportation Company, Rapid City, S. D.

San Luis Valley Transp. Company, Monte Vista, Colo.; Los Angeles-Albuquerque Express; County of Santa Barbara, California; E. B. Stone, Oakland, Cal.; Hertz Driv-Ur-Self Stations, Portland, Ore.

A typical Greyhound transcontinental bus, some of which are now equipped with General Motors Diesel engines.



Model CT 35-passenger Mack bus powered by a Mack-Lanova 519 cu. in. Diesel engine with electric drive.

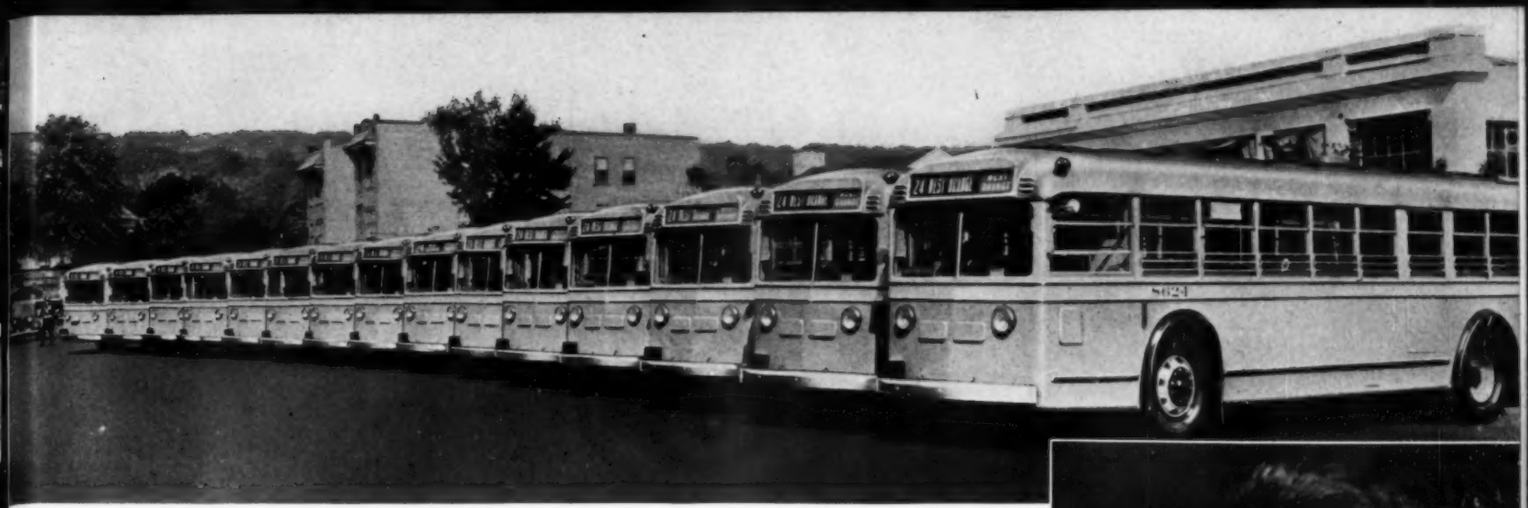
DIESEL ENGINES HAVE DEFINITE FUTURE IN TRUCKS AND BUSES, SAYS F. F. STANIFORD

President, Mack-International Motor Truck Co.

"HERE at Mack we feel that there is a definite future for Diesel power in motor trucks and buses. So far as trucks are concerned, we believe the Diesel engine will be largely confined to operations where annual mileages are fairly high. Only in such operations does fuel cost loom large enough to permit the fuel economy of the Diesel to offset its necessarily higher initial price. Heavy duty dump truck service in the construction and allied industries, where severe operation boosts gas consumption, also offers a fertile field for Diesel power. In the bus field the Diesel appears to have a particularly bright future both on account of the high mileage of long distance buses and the high fuel consumption of city buses resulting from frequent stops and starts.

"We do not feel, on the other hand, that European experience with Diesels is necessarily an indication of the trend to be expected in this country. Our unlimited supplies of high-grade gasoline and its low price will certainly keep the gasoline engine very prominently in the picture for low- and medium-mileage operation for some time to come. Furthermore, the emphatically higher standards of performance, smoothness of operation and reliability insisted upon by American buyers demands that Diesels for the American market must be superior in design, quality of materials and precision of manufacture to those available in Europe or heretofore offered in this country."

Model FK Mack truck, one of a huge fleet of Diesel-powered trucks in use in New York City and vicinity.



Fifteen of the twenty-seven Hercules powered Diesel electric buses operated by the Public Service Coordinated Transport of Newark, New Jersey

DEMAND IS INCREASING, SAYS CHARLES BALOUGH

President, Hercules Motors Corporation

"BASED upon developments of the past year, we believe the outlook for the modern high-speed Diesel engine will continue to broaden.

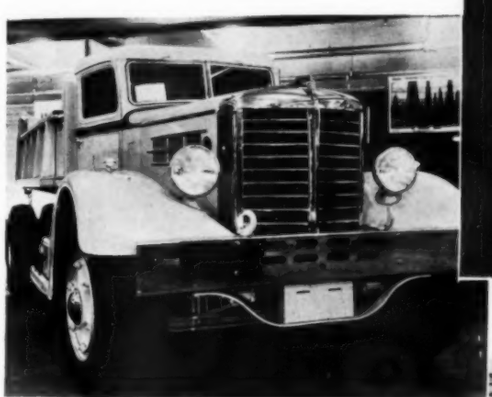
"Several truck manufacturers announced Diesel engines of their own manufacture during the last year. It may be some time before the results of this increased pressure by these newcomers into the Diesel field is felt. Still, it is an excellent indication of the increasing demands for the modern Diesel in truck operations.

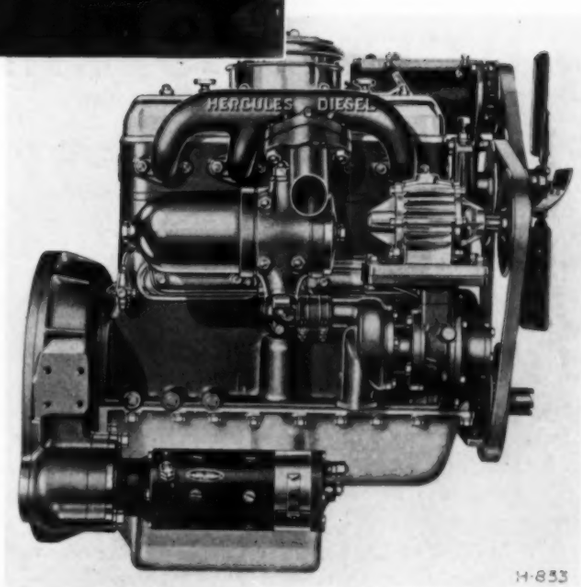
"The demands for Diesel engines are increasing in the tractor, marine and motor bus fields. Real progress has been made in the use of Diesel engines for passenger transportation in buses. Operating records of The Public Service Co-Ordinated of New Jersey – where twenty-nine Hercules Diesel electric buses have now covered over two million miles – show entirely satisfactory performance.

"In addition, Diesel bus fleets during the past year have given an excellent account of their ability in large centers of population, such as Boston, Baltimore, New York City and Toronto, Canada, and with the start of this year Birmingham and Philadelphia have been added to the list. The success of Hercules Diesel engines in all these fleet operations is very gratifying to us. The Twin Coach Company is shrewdly forecasting transportation needs in their development of their large fifty-six passenger Super-Twin Coach.

"Last year we added the Model 'DOOC' four-cylinder 226.2 cubic inch Diesel to our line. Its use by the Ford Motor Company in chassis for the export market is directly effecting the demand for and the use of this smaller Diesel for replacement use in the Ford and other small trucks.

"Manufacturers of Diesel engines are continuously working towards lighter weight, higher speeds and lower costs, and every year shows distinct forward steps in developing Diesel engines where they will more closely parallel the gasoline engine features that have generally been accepted as desirable in the many different types of service for which internal combustion engines of this character are used."





Above – Hercules powered Federal truck as exhibited at the New York Truck Show. At right – Model DOOC 4-cylinder 226.2 cu. in. Hercules Diesel as used by the Ford Motor Company for conversion purposes.

THE NEWCOMB, QUINCY, ILLINOIS

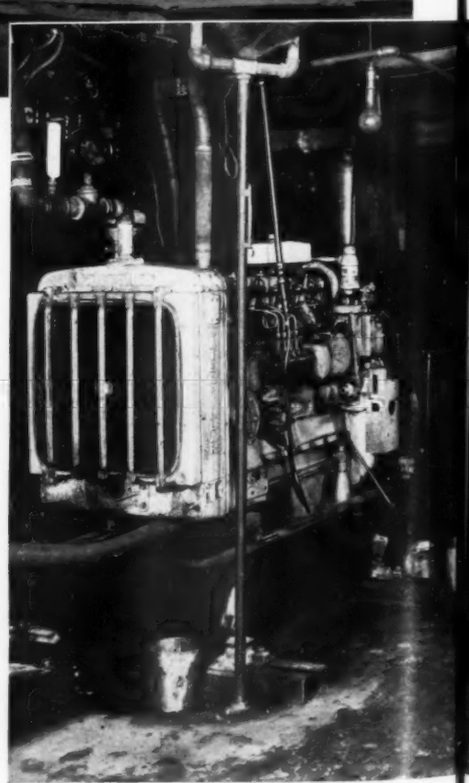
Another Dieselized Hotel

SOME few years ago, the Newcomb Hotel at Quincy, Illinois, began to completely remodel its lobbies, its amusement rooms, restaurants, and 115 guest rooms. It made them all strictly modern in design, furnishings, and equipment.

Up until that time, the management had been purchasing power at 4c per kwh., but with the expenses of renovating, etc., it was logical for them to look around for a more economical form of light and power.

The Newcomb is not a new hotel, for its rooms are large with high ceilings. It was found that the amount of light required, as a direct result of these construction features, was considerably more than might be expected for an average hotel of this size. As a matter of fact, it corresponded approximately to that needed for 200 ordinary rooms.

The most logical form of power to replace public service was the Diesel electric generator set, and a study of the load characteristics showed



Two radiator-cooled Caterpillar Diesel engines driving one generator. Using Vee belts and clutches, one engine is operated for normal loads, both engines for peak loads.

that, although normal load would be about 12½ kw., a peak of approximately 40 kw. could be expected during the early evening hours.

In September of 1936, the hotel management made the first cautious step. It installed a 44 hp. Caterpillar Diesel electric generator set, capable of producing sufficient current to supply the light during most of the day and night. Public utility was retained as a standby, to carry the load over its peak period, and to supply all power for house equipment.

In February of the following year, the management purchased a second 44 hp. Caterpillar engine, and connected the two of them to a Lincoln-Electric generator. By the use of V-belts and clutches, either one of the engines could be used under normal load, and both could be put to work during the peak periods.

With this set-up, the Newcomb had enough power to supply lights for the entire building under all circumstances. Tenants in its shops and offices were included in this group and purchased light from the hotel at a saving to themselves and a profit to the management. However, the electrical standby charge was high, and in view of this fact, the house continued to buy electricity to power all of its mechanical equipment.

Exterior view indicating the vintage from which interior modernization started.

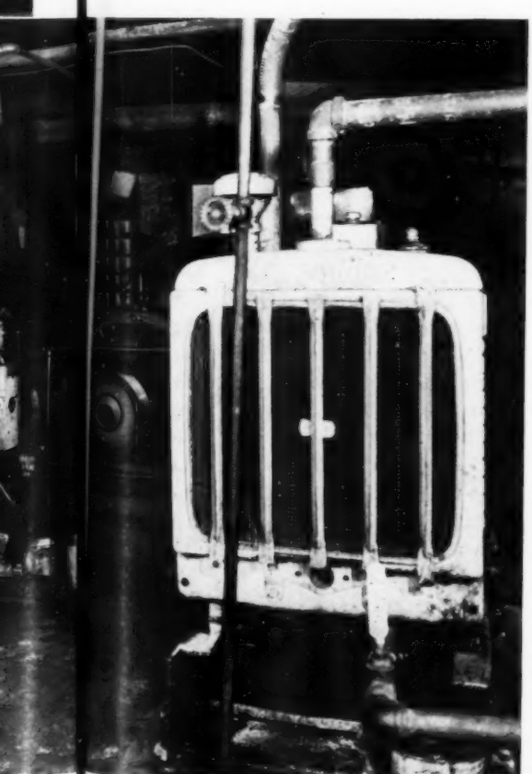
Today, the Newcomb has put 10,000 hours on one of its engines, and more than 9,500 on the other. Although the charges for purchased electrical power have come tumbling in the last year or two and now stand at 2½c, the management figures that the Diesels do the work for 2c, and through ingenious mechanical arrangements, account for various other savings.

It is interesting to see how the hotel overcame the problems of noise, vibration, etc., with a maximum of success at a minimum of cost. Cork lining of a concrete pit, and rubber mountings were utilized to minimize vibration and keep expenses low. Aside from the bark of the exhaust, noise offered little difficulty, in view of the fact that the well-built, thick-walled cellar provided sufficient insulation. The exhaust problem was solved inexpensively by the use of a muffler, and by carrying the exhaust gases through an extension pipe into the regular building flue.

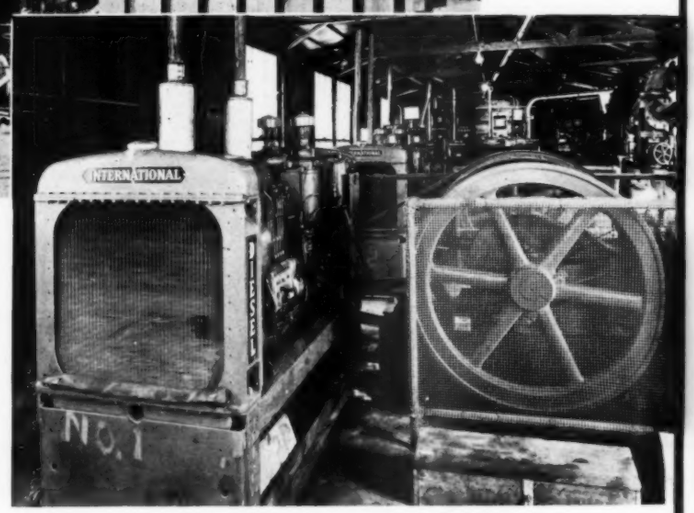
Still with an eye for economy and, at the same time, considering the efficiency of their equipment, the management put in simple, home-made warning signals that keep tab on the amount of fuel oil in the 320 gallon storage tank. Moreover, should something go wrong with the transfer pump, the engine automatically draws on a reserve supply. As soon as this switch-over is made, lights and buzzers warn of the trouble.

The storage tank itself is chemically checked at regular intervals to determine the amount of sediment and water present. So far, using an accredited fuel, the hotel has had no trouble along these lines.

Another neat saving is made by utilizing the heat dissipated into the cooling water. Water from the engines passes directly into a surge tank, and from there, into coils around a boiler, where it is pre-heated to serve the house. The temperature is brought up to 100 degrees F. by this method, and from there, the job is taken over by a coal fired boiler. However, the pre-heating method is so efficient that more than half of the fuel bill for water heating is saved each month.



The remodeled lobby typical of the changes wrought throughout the Newcomb Hotel.



Two Model PD-80 International Diesel power units, operating air compressors at Memphis, Tennessee.

DIESELS AT MEMPHIS

By GEORGE D. CROSSLEY

THREE International Diesel power units and a fleet of International motor trucks are utilized on the Memphis sewer-tunnel project. Two are Model PD-80 Diesel power units operated by the Nolan Construction Co., one of the two contractors working on the job. Both of these Diesel units are equipped with electric starters and are operating air compressors requiring 70 hp. apiece. On this same job a Model PD-40 International Diesel power unit is being used on a crane for lifting sand cars from tunnel to loading platform where a fleet of International trucks carry it off.

Stench from Wolf River at low water stages made the city's front yard an unsavory place, because of the sewerage emptying into the harbor. The City of Memphis obtained a grant of $845,000 from P.W.A. for the construction of the sewer and sold $1,085,000 in bonds to make up the rest of the cost of the project. This work started last May and will require approximately two years to finish. The tunnel when completed will be 14,500 ft. long—nearly three miles. The connecting sewer lines from about fifteen leading city streets will empty into and be carried off to below the city and then emptied into the Mississippi River. Before the sewerage would enter the river proper, however, it will run into a big sewer box with an outlet so constructed that when the Mississippi River is about 34 or 35 ft. the gate will be closed and a pumping station in the north end of the city will flush the sewerage out into Wolf River and, by closing the lower end of the city gates, prevent flooding of the system at flood stage. This system will handle the sewerage from an area occupied by 120,000 of the Memphis population and climaxes an extensive sewerage program carried out by the city to serve territory annexed in 1930—almost doubling the area of city.

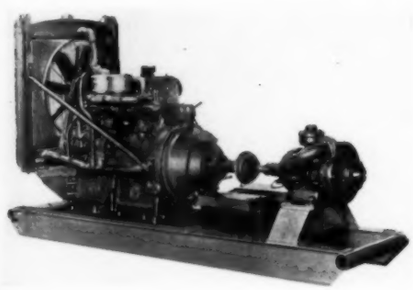
The sewer will be as much as 100 ft. below the surface at some points, necessitating construction operations under compressed air; that is, the tubes will have to be kept under air pressure in order to keep seepage out. The tunnel at the discharge end is 7½ ft. in diameter. They use a tunnel digging machine which is expected to revolutionize the tunneling business. The machine has been used before only in tunneling through embankments, short distances, and not very deep. The machine has a cutting edge with two huge revolving knife blades and simply bores its way. The cutter is driven by a powerful electric motor, and the whole machine is moved ahead by hydraulic jacks.

And so another instance of how Diesel engines fit into the requirements of a contractor handling a tough job: Three Diesel engines successfully cutting costs and doing the work.

DIESEL ENGINES UTILIZED IN ILLINOIS OIL FIELD

GUIBERSON pumps, manufactured by The Guiberson Corporation of Dallas, Texas, and powered by Hercules Diesel engines, have recently been placed in service in the Illinois area. The ease of portability and the compact arrangement of the units are clearly shown in the accompanying photograph.

The first Guiberson pumps installed in the Illinois area are Type 4FB8. These pumps are powered by Hercules Diesel engines DJXC, 3¾" x 4½". These pumps are used on pipe line service and operate at 1,400 rpm. They have a capacity of 130 Bhp. at about 550 pounds pressure. However, these units will pump satisfactorily at pressures up to 600 pounds.

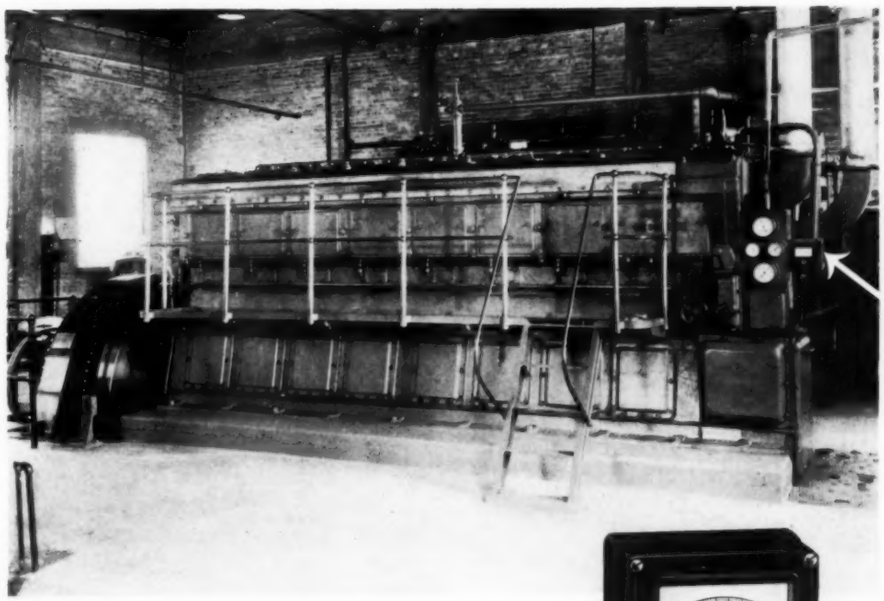


The larger Guiberson pump, shown in the illustration, is their Type 6FB5 and is powered by Hercules Diesel engine DHXB, 5" x 6". These units are operating under the following conditions: 1,350 rpm., 280 Bhp., 750 pounds pressure, and are designed to pump against pressures to 1,000 pounds. All of the units are operating very satisfactorily.

Diesel power is becoming increasingly popular in oil field operations, particularly where natural gas is not available and where electric current is high in price or not convenient for hook-up in all applications.

An outstanding advantage claimed for Diesel over gasoline engine power is greatly lowered fuel cost. Obviously, the lower fire hazard in connection with the use of Diesel fuel as compared with gasoline, is another important consideration.

Hercules Motors Corporation is rapidly expanding its oil field operations. Announcement has been made recently of the opening of Hercules sales and service branches at Houston and Kilgore, Texas — and further developments are said to be in prospect. Mr. A. B. Wehling, with headquarters at the Houston branch, is in charge of Mid-Continent operations.



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THE SHINER, Texas, municipal light plant has operated Diesels over a period of more than 20 years with such success and economy that each year has added to the number of consumers and plant load, likewise to the income and profits.

Not only has the revenue paid for the engines and plant improvements, but other municipal improvements and equipment have been purchased out of light plant earnings.

The latest addition to the light plant is a 375 hp. Cooper-Bessemer Diesel engine four cycle, solid injection of the constant pressure atmospheric relief system type. This modern Diesel is equipped with all modern accessories including an Alnor Model RB Exhaust Pyrometer, see illustration at right, mounted on the end of the engine with other gauges as shown by the arrow in view above.

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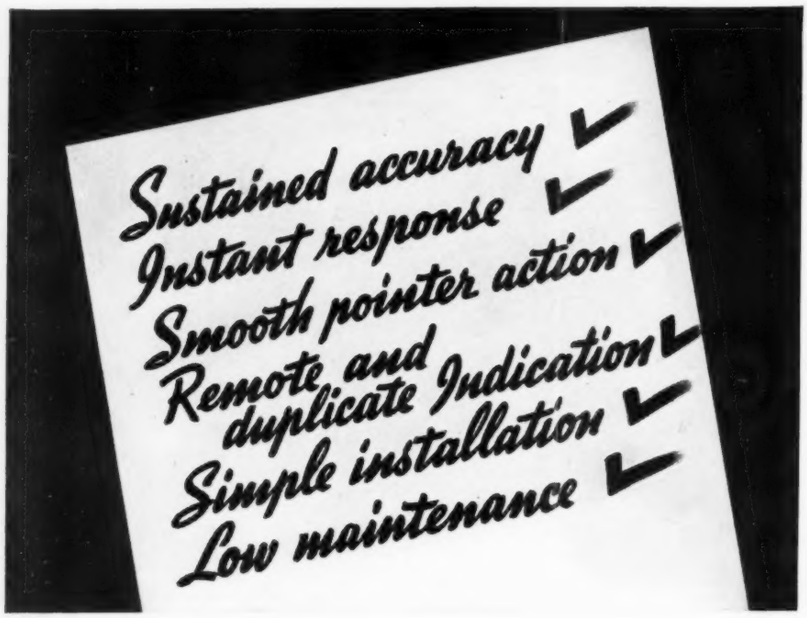

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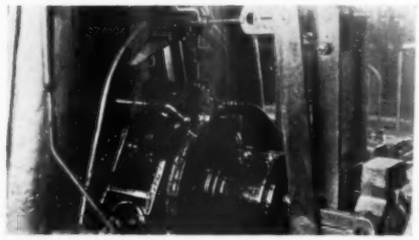
CLEANING AS I FF OPERATION AN IAI

By L. OHNS

THAT Diesel engines require periodic cleaning attention if maximum operating performance, economy and long life of equipment are to be obtained is a well-known fact indisputably confirmed by the experience of hundreds of Diesel operators . . . yet cleaning has remained, to a large extent, a difficult problem, due not only to the variety and nature of efficiency-hindering deposits which must be removed, but also to the wide variance in the procedures which have been used to effect their removal. The net result is that some operators, who have carefully analyzed their cleaning requirements, enjoy more effective maintenance at less cost than others.

This problem of cleaning can be broadly divided into two parts. One deals with surfaces with which cooling water comes in contact, such as the water jackets and radiators. In certain types of Diesel installations, such accessory equipment as lubricating oil coolers, air compressors and other water-cooled units are also included. The second classification covers the surfaces of Diesel crankcases, lubricating oil coolers and the lines connecting equipment.



Auxiliary equipment, such as the governor shown here, also often collects heavy grease and oil accumulations, which must be removed for the sake of appearance.

During recent months, a substantial number of new developments and improvements in methods and materials have been made for handling both types of work with a degree of safety and effectiveness that, from the standpoint of results, has not been generally possible heretofore. Given below are practical methods and principles which, based on 30 years' research and experience of the nation-wide Oakite service organization, have proved their effectiveness and economy under a wide variety of local conditions in all sections of the country.

Cooling System Maintenance

In cleaning Diesel water jackets and radiators, the first step to follow is to flush out the system thoroughly to remove as much as possible

**Oakite Products, Inc., New York, N. Y.*

S EFFECTS DIESEL AN MAINTENANCE

By L. OHNSON*

of loose rust, mud and other insoluble matter. Then the system should be refilled with clear water, and a solution of Oakite Penetrant, made up at a strength of one to two ounces per gallon, should be added. By incorporating both a solvent and an emulsifying action, this material provides that essential combination of cleaning properties which makes possible thorough loosening and removal of all the types of oil and grease deposits ordinarily encountered.

The solution should be circulated through the system by operating the engine from one to two hours. This alkaline material is so compounded as to have no damaging action or other harmful effect on sensitive metal surfaces, such as aluminum water manifolds, for example, used in some types of railroad Diesel installations. To complete the cleaning operation, the system is drained while the solution is still hot and then flushed out with hot water.

As this photograph illustrates, cleaning is completed with a high pressure hot water rinse, by which deposits are completely flushed away together with the cleaning solution, thus leaving surfaces in dry, film-free condition.

While oil and grease accumulations frequently interfere with the proper cooling effect which the cooling water must provide, rust and scale deposits in most cases present the most serious trouble.

Until a short time ago, the removal of hard water scale and rust deposits was generally effected through the use of raw commercial acids, or by costly, time-consuming mechanical methods. While comparatively economical, raw acids are being used much less today than ever before, due to the fact that many Diesel operators have found by experience that raw acids cannot remove oxide and scale formations without chemically attacking the underlying base metal of the surfaces treated, a serious handicap considering the high initial cost of Diesels, and the heavy expense incidental to major repairs. Raw acids, for this reason, have

. . . . . *And now please turn to page* 64

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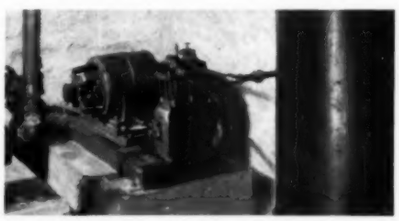

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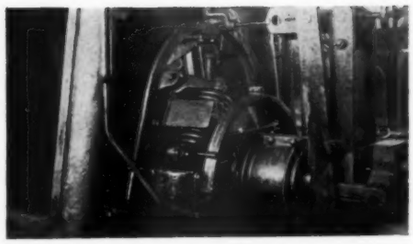
CLEANING A DIESEL

. . . . *Continued from page* 63 . . . .

come to be regarded by many engineers, superintendents and foremen in charge of Diesel maintenace as unsatisfactory for this type of work.

Here again an improved type of material, Oakite Compound No. 32, has been developed to meet the need for a material that would prove far more suitable for rust and scale removal than the raw acids. Today, as a result, it is practical for Diesel operators to remove rust and scale deposits more effectively with a high degree of safety, at a cost that is low.

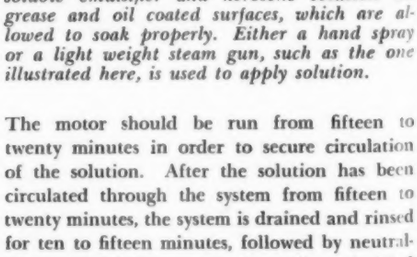
This material possesses a more extensive range of activity than any of the raw commercial acids, and yet is so compounded as to have practically no injurious effect on the underlying base metals treated. It is safe to use on brass, bronze and steel, and is by far much safer than ordinary commercial acids on cast iron. An indication of how great has been this increase in safety to equipment is shown in the graph reproduced here which shows clearly the exceptionally low metal loss on iron and steel by this particular material as compared with raw acid.



Here is the governor after cleaning. Note the absence of grease and oil films . . . the attractive, spic-and-span appearance of the unit.

The method of application is relatively simple. Before using the material, however, the cooling system should first be flushed out thoroughly with an Oakite Penetrant solution, so that any oil or grease present will be removed. Then the system is drained and rinsed thoroughly with clear water. It is filled with one-third full of water, the required amount of Oakite Compound No. 32 added, and then filled with water to within a few inches of the top.

The amount of Oakite Compound No. 32 required will depend upon several factors, namely, the capacity of the system, amount of scale present, and the time allotted to cleaning. But, as a general rule, one pint to one quart of material for each gallon of water is used. Titration methods indicate the progress of the scale removal, and make it easy to maintain the solution at the proper working strength.



Cleaning is accomplished simply by spraying oil soluble emulsifier and kerosene solution on grease and oil coated surfaces, which are allowed to soak properly. Either a hand spray or a light weight steam gun, such as the one illustrated here, is used to apply solution.

The motor should be run from fifteen to twenty minutes in order to secure circulation of the solution. After the solution has been circulated through the system from fifteen to twenty minutes, the system is drained and rinsed for ten to fifteen minutes, followed by neutralizing. For this purpose, the radiator is filled with water and an ounce per gallon solution of Oakite Penetrant is added, subsequently followed by a clear water rinse, thus completing the cleaning operation.

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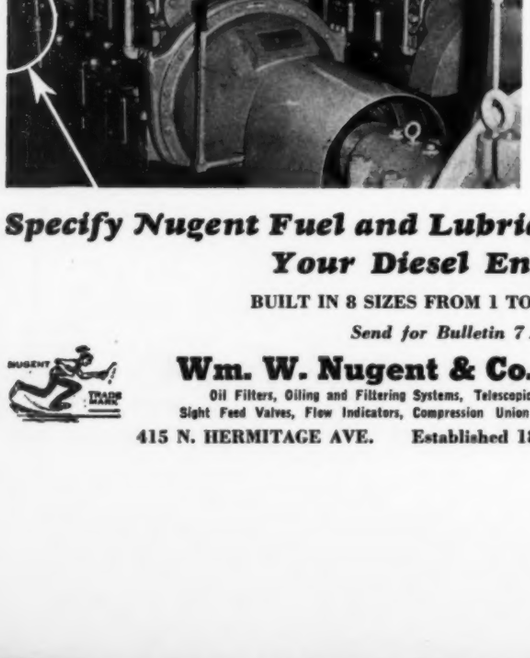

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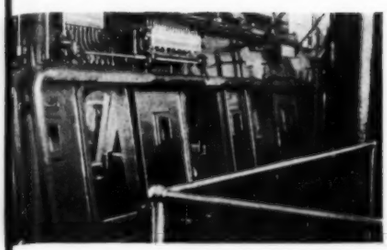


his external view of an 800 hp. Diesel en- operated in one Mid-Western oil pumping on, the side plates have been removed and crank case is ready for cleaning.

Closely related to the necessity of keeping a Diesel cooling system clean is the need for the use of suitable lubricating oils, their periodic replacement or reclamation to remove the sludge that invariably deposits. Sludge in the lubricating system means decreased lubricating efficiency, increased wear on the pistons and other working parts, and higher operating temperatures. This latter point becomes especially important when it is realized that it readily promotes faster deposition in the water jackets of any scale constituents of the coolant.

Cleaning Diesel Crank Cases

Cleaning of Diesel crank cases has long been a disagreeable job due to a combination of factors, the principal ones being that the results obtained with hand wiping methods not only involved high cost, but also often proved unsatisfactory. Considerable effort was required in scraping and wiping down surfaces to approach a satisfactory job of removing heavy accumulations of sludge, dirt, grease and oil deposits. Workmen, furthermore, naturally disliked crawling into a filthy crank case to work.

A more satisfactory method from the standpoint of results, and a more pleasant and convenient way of handling the job has been made practically possible by another Oakite development, which, in addition, eliminates a substantial amount of the laborious wiping and scraping of surfaces previously required in doing this maintenance work. This improved method is predicated on the use of an oil soluble emulsifier, Oakite Composition No. 9, which is mixed with kerosene or light fuel oil to provide a combination of unique emulsifying properties with rapid penetrating action.

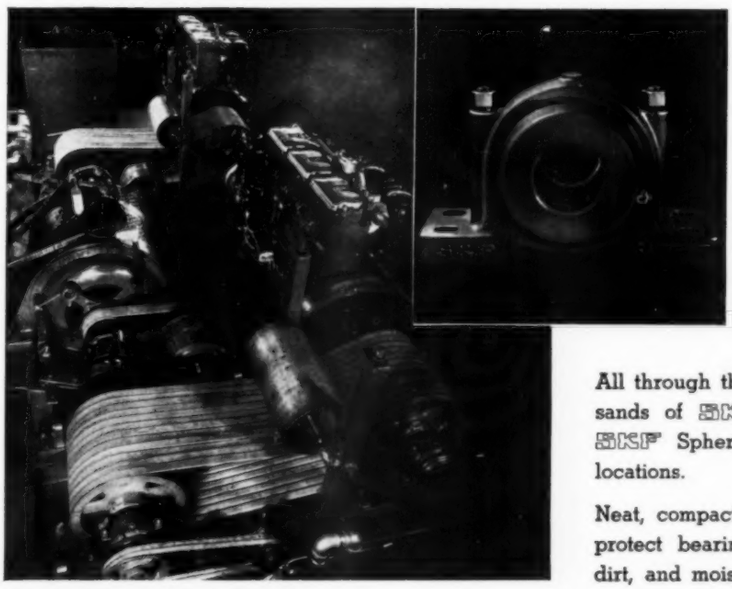
The mixture is first sprayed on interior surfaces of the crank case and then allowed to soak from one to three hours, depending upon the condition of the crank case. After being thoroughly loosened and softened, sludge and carbonized oil accumulations are flushed and carried away together with the solution by rinsing with water and compressed air.

Indicative of the savings in time and effort now possible with this method and material is the recent experience of a prominent Mid-Western oil company's pipe line department, where this particular maintenance operation had long been a troublesome problem.

. . . . . *And now please turn to page* 66

OUTBOARD LOCATIONS OF DIESEL ENGINES ARE

WELL-BEARINGED IF



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CLEANING A DIESEL

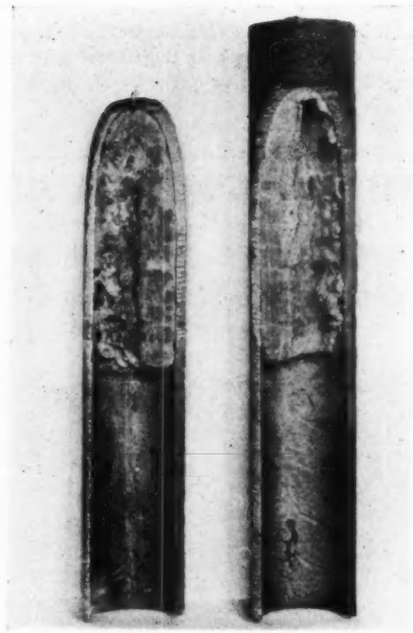
. . . . *Continued from page* 65 . . . .

Until recently it took two men, using wiping rags and solvent, one day to clean the crank case of the 800 hp. 8 cylinder Diesel engine in this power station. The cost was high and the results obtained were not regarded as satisfactory. Believing, therefore, that a marked improvement could be made without entailing considerable expense, the chief mechanic decided to make a practical test with the Oakite method and material.

Accordingly, the crank case was sprayed down with a solution of Oakite Composition No. 9 and distillate. A simple hand-spray was used. The mixture was allowed to soak for three hours. To complete the job, crank case surfaces were rinsed with water. A light weight steam gun, utilizing 100 pounds of air in place of the usual steam pressure, was employed for this rinsing. So successful were the results obtained that the cleaning job was pronounced the best this concern had ever had. Wiping was restricted to a few minutes' work to a few spots which were inaccessible to the rinse.

Cleaning Heat Exchangers

The problem of cleaning fuel oil heaters, oil coolers and other heat exchangers is one that is very closely allied to cleaning Diesel cooling systems. Economical maintenance of such equipment at maximum working efficiency demands that both the water side and the oil side must be cleaned of heat-insulating deposits and accumulations at periodic intervals, which are governed largely by the operator's own operating conditions.



Indicative of the way in which scale is cleanly removed from Diesel engine water jackets and radiators with Oakite Compound No. 32 are these cross-sections of heat exchanger tubes. Part of the scale has been retained without treatment, to show completeness of removal of a very heavy deposit.

Circulation of the descaling or oil deposit removing solution through fouled equipment (the material used depends, of course, upon the type of deposits to be removed), followed by thoroughly flushing with water, is the general method recommended and serviced by the Oakite organization. As each cleaning job is generally an individual case by itself, it is virtually impossible to give specific directions as to amount of cleaning material to be used, time required for circulation of solution, etc., that will work in all cases. But there are, however, certain points about the circulation method applicable to nearly all heat exchanger cleaning operations which should be mentioned.

Equipment used for cleaning consists of a large and adequate pump, an open solution tank in which to mix the cleaning material, piping connections and valves, and steam connection for heating the solution and steam or air connections to provide additional force or agitation to the cleaning solution while it is flowing through the heat exchanger.

The circulating method provides several worthwhile features, the first of which is the principal of "reverse flow." In hundreds of instances,

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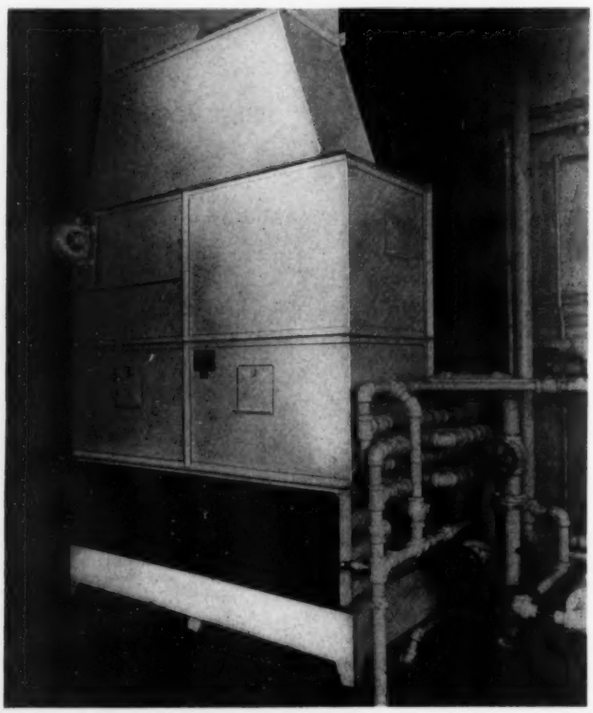

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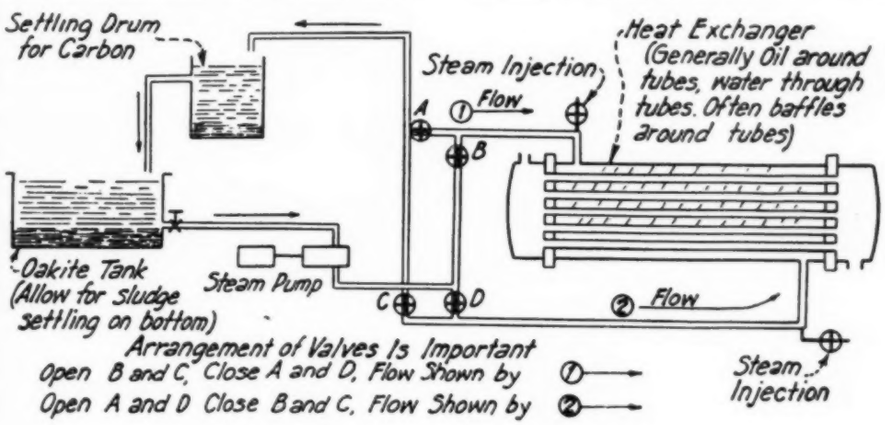
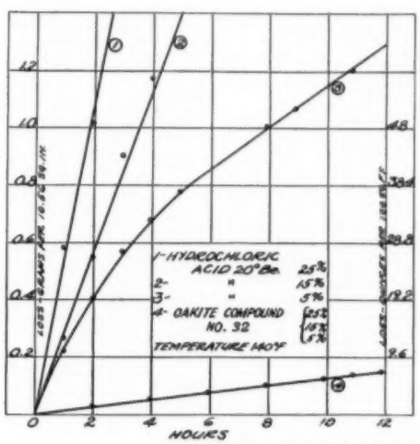
it has been shown that quicker, more thorough and effective cleaning is secured when the directional flow of the solution is frequently changed during the cleaning operation. Generally, it proves economical to add the fittings and valves needed to effect reversal of flow.

Providing these connections for steam injection also facilitates the disintegration and removal of deposits which resist other treatment. Lastly, the use of a settling drum before the cleaning solution returns to the tank also has been found definitely advantageous. If the deposits are of such a nature that a considerable amount of insoluble matter comes out with the cleaning solution, experience has shown that it is preferable to trap the insoluble matter in a settling drum rather than allow it to be picked up by the pump and recirculated into the heat exchanger.


Settling Drum for Carbon
Steam Injection
Heat Exchanger (Generally Oil around tubes, water through tubes. Often baffles around tubes)
Flow
A
B
C
D
Oakite Tank (Allow for Sludge settling on bottom)
Steam Pump
Flow
Steam Injection
Arrangement of Valves Is Important
Open B and C, Close A and D, Flow Shown by
Open A and D Close B and C, Flow Shown by

This sketch illustrates a typical hook-up of the Oakite circulation method of cleaning heat exchangers.

Cleaning in relation to the maintenance and operation of Diesel engines and accessory equipment is a problem that varies greatly with different operators. Natural water supplies, the grade of lubricating oils used, methods of clarifying or reclaiming the oil, use to which equipment is put and other factors vary the frequency of cleaning, but under any conditions a time comes even with the best operating methods when cleaning is essential. The use of the safe, improved materials and practical methods available today means not only a sure return of efficient, low-cost equipment operation, but provides that factor of safety so essential to equipment representing so high an investment.



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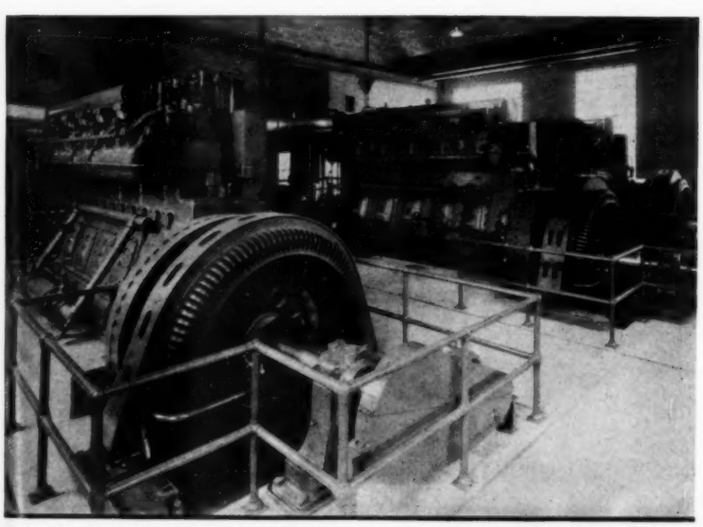
Graphically illustrated here is the low metal loss on iron and steel, of a compound developed specifically for safe rust and scale removal, as compared with raw acid.



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RUMOR! ! !

IT is rumored that the Allis-Chalmers Mfg. Co. is planning to discontinue the manufacture of their own line of Hesselman type oil engines for their tractors in favor of buying their Diesel engine requirements from the General Motors Corporation. We expect to be able to supply full details in our May issue.

TWENTY-FIVE NEW BUSES

BURLINGTON TRANSPORTATION COMPANY has just purchased twenty-five new Yellow Coach buses to be powered with the 71 Series General Motors 2-cycle Diesel engines. These will be used for trans-continental service to the Fair at San Francisco, California, the first all-Diesel transcontinental fleet in the country.

BALTIMORE SALES

1 – 380 hp. Atlas Imperial Diesel engine, 6 cylinders, 13″ bore x 16″ stroke to The Edwards Co., Inc., Reedville, Va., for installation in their Menhaden boat *Harry K. Fooks.*

1 – 275 hp. Atlas Imperial Diesel engine, 6 cylinders, 11½″ bore x 15″ stroke to the McNeal Co., Inc., Reedville, Va., for installation in their Menhaden boat *Peconic.*

1 – 160 hp. Atlas Imperial Diesel engine, 6 cylinders, 9″ bore x 12″ stroke to J. Willis and Charles A. Smith, Baltimore, Md., for installation in their converted schooner *La Forrest L. Simmons.*

All of these sales were made by the Fleck Engineering Co., distributors in the Baltimore territory for the Atlas Imperial Diesel Engine Co., of Oakland, California, and Mattoon, Illinois.

ALL ABOUT DIESELS TOLD IN FREE BOOK OFFERED BY DODGE

CURRENT interest of the transportation world in the Diesel engine is given educational aid and added impetus by an illustrated booklet, "Dodge and Diesel." Copy of the booklet, we learn, will be mailed, free, to anyone writing for it to D. W. Lee of the truck sales department of the Dodge Division of Chrysler Corporation, Detroit.

The company's evident desire to bring greater Diesel consciousness to the transportation fraternity as well as to the general public was motivated by the recent introduction of a Diesel-powered Dodge 3-ton truck. This new heavy-duty Dodge Diesel has been in production long enough to bear out the claim of its engineers that the highly desirable operating economies of the oil-burning engine that has no electrical ignition and no carburetor, yet starts as readily and continues to operate as reliably and flexibly as a gasoline engine, are

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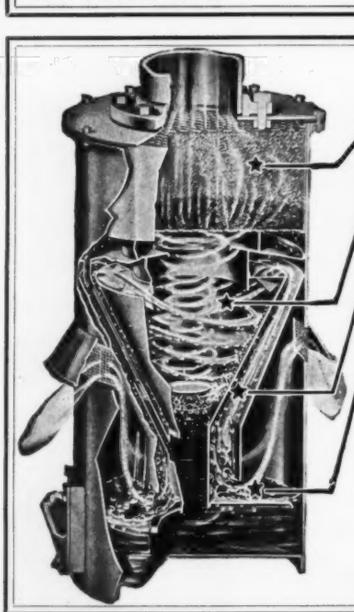

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THE OIL BATH AIR FILTER
The four distinct cleaning operations listed above are available only in the Cycoil Oil Bath Cleaner. Such a combination assures a continued self-cleaning action.
● Developed for protection of engines and compressors subjected to extremely heavy dust concentrations, the Cycoil incorporates a new pre-cleaning action by which an oil spray mixes with the incoming air and passes into a pre-cleaning chamber where the bulk of the dust is removed by centrifugal action.
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Incorporated
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PETROMETERS INDICATE IN EVERY TYPE OF TANK
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SEATTLE 503 Westlake North
MEMPHIS 421 Monroe Ave.
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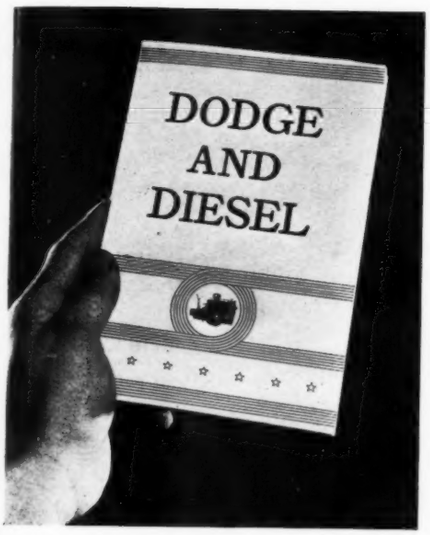
FOR SALE—Three 300 hp. new heavy-duty Diesel engines, 4-cylinder, 4-cycle. 12½″ by 16″. Demonstration on request.
RAMBERG IRON WORKS
37 Van Dyke Street Brooklyn, N. Y.
Tele. CUmberland 6-3960



being successfully achieved in the new Dodge Diesel.

Meanwhile the company is embarking on broad missionary work through the distribution of informative Diesel literature, the very word "Diesel" still being little more than a name to many persons.

The texts presented in "Dodge and Diesel" explain and drawings illustrate what the Diesel engine is and how it operates as compared with the conventional gasoline engine. Facts about the "Full Diesel" and the "Semi-Diesel" and between 4 and 2-cycle Diesels are set forth, as well as the manner in which the "True Diesel" engine developed by Dodge functions with a compression two and a half times as high as that of the gasoline engine, starts instantly in below-zero weather, and operates without the use of ignition coils, distributors, spark plugs, etc.

Though "Dodge and Diesel" is free for the asking, its Diesel facts are presented without excessive bias; hence the work serves its intended purpose which, we are told, is to give wider spread to an understanding of the Diesel operation and advantages.

FRANK OBERLE JOINS AMERICAN BOSCH

FRANK OBERLE, formerly a member of the Diesel sales division of Hercules Motor Corporation, Canton, Ohio, has joined the sales division of the American Bosch Corporation, Springfield, Mass.

Mr. Oberle has been previously connected with the American Bosch organization for many years as a fuel injection equipment sales engineer.

"Our Marley *Spray-Coil* Cooling Tower at the Winchester, Illinois, R.E.A. Plant Uses LESS WATER even in the HOTTEST WEATHER"

The MARLEY Company
INTER-OFFICE CORRESPONDENCE

Subject: Illinois Rural Electric Co. Winchester, Illinois (Busch-Sulzer Bros.—D. E. Co.)
From: St. Louis, Mo.
To: Home Office Kansas City, Kans.

Marley Order No.: 16513—1938 *Date:* October 11, 1938

Gentlemen:

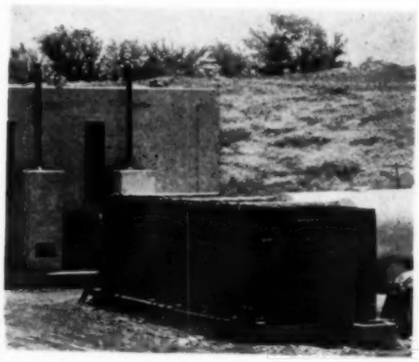
Some months ago we sold to the above, through the Caldwell Engineering Co. of Jacksonville, Ill., one of our Spray Coil Towers for use at the new Winchester, Ill., R. E. A. Diesel electric plant.

While in that vicinity last week I inspected this plant and found the staff highly pleased with the performance the tower is giving. The engineer in charge told me that even during the hottest weather of last summer they had not found it necessary to circulate the full capacity of raw water over the coils to maintain proper and constant engine temperatures.

At the present time the coils are just as clean and bright as the day they were put in.

Yours very truly,
B. L. Proctz

See Article on Page 42 about this plant and its Marley Heat-Exchange Equipment



Long experience, wide diversity in types of equipment plus standardization and volume production enable Marley veteran engineers to work out the most efficient and economical solution to any water cooling problem, whatever your individual requirements.

For Complete Information on Spray-Coil Cooling Towers Write Now for Bulletin 301

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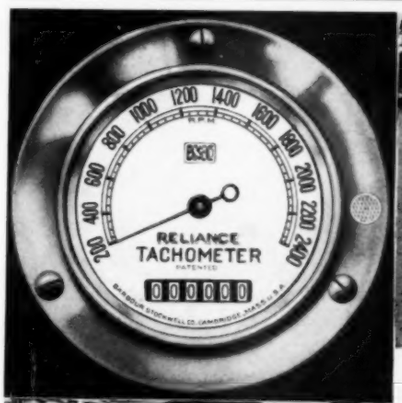
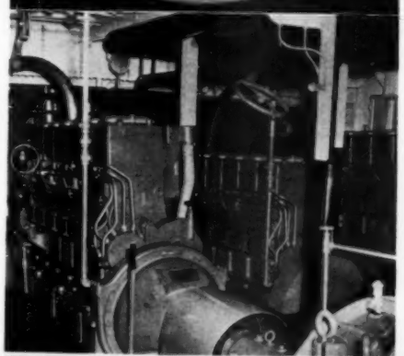
Sales Offices or Agents in Principal Cities





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THROUGHOUT the diesel world—it's RELIANCE—preferred among Diesel builders for their absolute ACCURACY in indicating engine performance.

ACCURACY—that's why you'll find Reliance installed on the five Cummins Diesels on the new Russian Fireboat illustrated.

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CAMBRIDGE, MASSACHUSETTS

*Naval Architect—John G. Alden, Boston, Massachusetts.
*Built by Rice Brothers Corporation, East Boothbay, Maine.

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ACCURATE - DEPENDABLE - INDISPENSABLE

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PENN MACHINERY SHOW AND "GET-TO-GETHER" A HUGE SUCCESS

ON the afternoon and evening of February 21, the entire personnel of the H. O. Penn Machinery Co. of New York, Poughkeepsie, and Mineola, were hosts at a "Get Together" and machinery show which set new all time records for attendance and interest. More than eleven hundred contractors, operators, and public officials attended the stag affair which opened its doors at 4 P.M. and lasted until midnight.

The huge new show room, overlooking the East River at 140th Street, received widespread acclaim from all visitors. Men from the Caterpillar factory pointed out the fact that this is the largest and finest distributor showroom in the United States. The main room of the enlarged quarters contains nearly 15,000 square feet, and the ceilings are of such towering heights as to permit effective display of the large 1½ cu. yd. "full measure" Marion Shovel, as pictured with this article.

Unusual photos adorned the walls, most of them being enlarged "shots" of jobs well done by local contractors. Photos of local Caterpillar Diesel engine installations were also shown in power plants, fishing boats, and party boats, in which field Caterpillar has just recently taken its place in the sun.

The Speeder LS80 shovel was the source of great interest because of the many quick clean-up jobs being undertaken at this time throughout the eastern territory. This small, fast, easy to handle, light weight shovel has found a soft spot in the hearts of operators that no competition has been able to approach.

The John Deere gasoline tractors and plows, the Friend sprayer, as well as the Caterpillar farm equipment displayed, were the main attractions for many of the visitors from up-state, which territory is served by the Poughkeepsie

The Caterpillar display was one of the most complete and comprehensive ever seen outside of the factory. The famous Caterpillar Diesel tractors from the speedy D2 to the massive D8, were accorded spacious surroundings for proper inspection and admiration. The large and versatile No. 12 and No. 10 auto patrols were placed in a corner of the tremendous show room. Allied equipment, including the LeTourneau Scraper, was displayed.

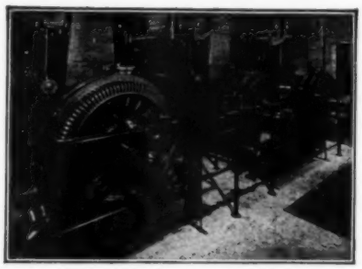
A section of the showroom was devoted to entertaining and educational movies. All during the show – for more than eight (8) consecutive hours – the "theatre" was filled and overflowing its seating capacity of 200.

Crowds viewed the Caterpillar engine cutaways with enthusiasm and praised the simplicity of the engine, the principles of which were further effectively explained in talking movies.

branch of the Penn organization. Yes, the crowds came from the country, from the cities, from the towns and municipalities, stretching from the tip of Long Island across the Hudson River far into New Jersey and up into New York State and Connecticut. Here was an audience of men who came from far and near to see a show that was of vital interest to them. Not a bored expression was detected during the entire stretch of the program. Nor was a salesman caught with an order blank in his hand, for this was another of H. O. Penn's great "Get Togethers" – events to be anticipated with the kind of pleasure and interest for which the man is famous throughout the entire territory.

This was unquestionably the largest individually sponsored machinery show ever seen in the east. No wonder men came from afar and stayed to inspect and enjoy this new type of show.

ONLY BUCKEYE DIESELS



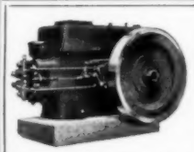
GIVE YOU ALL THESE FEATURES

1. Silent Watchman (Patented).
2. Full pressure lubrication system.
3. Sleeve cylinders.
4. Exhaust and intake manifolds not bolted to cylinder head.
5. Reversible shell type silver alloy bearings.
6. Individual pump for each cylinder.
7. Completely enclosed.

They insure long life, high efficiency, low maintenance—all meaning lower power costs.

Write for catalogs on your letter-head.

The Buckeye Machine Co.
Lima, Ohio
Engine Builders Since 1908



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Acro combustion chamber (pat.)
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DIESEL PROGRESS

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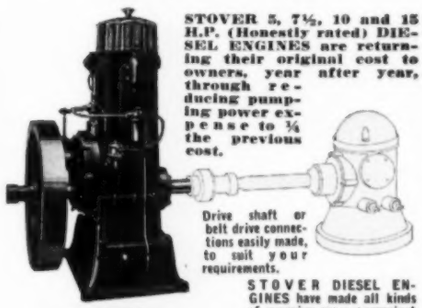

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Drive shaft or belt drive connections easily made, to suit your requirements.

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5. Compact and sturdy with all parts, except flywheel, enclosed and running in oil.
6. Semi-portable, with all parts easily accessible for adjustment or replacement.
7. Balanced for marine service. Dependable under worst conditions. Eliminate fire hazard.

WATCH THEM GROW IN SIZE AND POPULARITY

You can get the facts and figures covering the many ways STOVER DIESELS are cutting power costs 75% just by writing to Dept. DE-64 for Special Diesel Bulletin.

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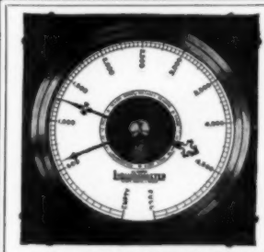

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NEW OIL-"RPM" DELO SUCCESSFULLY LUBRICATES ALL TYPES OF DIESELS

AFTER 10,000,000 test miles – over 400 times the distance around the world – after 90,000 test hours – equal to ten continuous years of testing – Standard Oil Company of California is announcing its New "RPM" Delo (Diesel Engine Lubricating Oil.)

Standard Oil engineers are confident that this New "RPM" Diesel Engine Lubricating Oil will bring the maximum service benefits of correct lubrication to ALL Diesel engines, regardless of size or design. These scientists stress the point that now giant Diesels in power and industrial plants, small high-speed Diesels in trucks and busses, rugged Diesels in tractors and aboard ships – every one – can derive full lubrication protection from its proper S.A.E. grade of New "RPM" Delo.

To meet all requirements of all Diesels, New "RPM" Delo possesses the following important properties as established by exhaustive field and laboratory research:

1 – It prevents ring-sticking even under the most severe engine operating conditions. In comparison with other oils it claims to be appreciably superior in the maintenance of piston cleanliness and the prevention of carbon and sludge deposits in oil ring slots.

2 – It is non-corrosive to alloy bearings and is, therefore, suitable for use in all engines, regardless of bearing materials. New "RPM" Delo is highly recommended for engines employing copper-lead, cadmium-silver, Satco and similar types of bearing materials.

3 – It reduces wear of cylinders, pistons and rings.

4 – The compounding material used in New "RPM" Delo is a powerful anti-oxidant. Thus this lubricant is highly resistant to oxidation and deterioration.

5 – In addition New "RPM" Delo's compounding is stable in the presence of moisture and in storage.

6 – Due to its great stability, New "RPM" Delo will reduce filter clogging to the very minimum.

7 – This lubricant minimizes cylinder and ring wear in high temperature regions such as the tops of pistons. This is because of New "RPM" Delo's unusual capacity to *spread* and lubricate hot metal surfaces instead of receding and leaving them dry. This vital property may well be described as "high engine film strength."

8 – New "RPM" Delo protects all bearing surfaces, piston rings and cylinders during the critical breaking-in period.

The development of New "RPM" Delo with all these qualities to assure clean-engine operation and long peak-power performance is a "Marco Polo" adventure in lubrication engineering.

While their research has been based principally on high speed Diesel engines of moderate horsepower, Standard Oil engineers point out that their field work on New "RPM" Delo also has included extensive investigation of the use of this product in many other types of Diesels, including slow and medium speed installations of a wide range of power output. As a result of its performance in unprecedented laboratory and field testing New "RPM" Delo (in proper S.A.E. grades) appears capable of lubricating all sizes and types of Diesel engines correctly. However, improved lubrication resulting from its use generally will be noted sooner in smaller, high-speed Diesels. All this points to successful Diesel operation at higher loads and with greater economy in maintenance, lubricating oil and fuel.

CLORODINE CLEANS JACKETS

RUST and scale that form in engine cooling-jackets have hitherto been removed by methods troublesome, laborious, and, for the most part, ineffective. Now, there is available a process that can be employed without any dismantling of the engine, that is easy, quick, highly effective, and not costly.

This process uses two products developed by the American Chemical Paint Company – Trisila and Clorodine. The Trisila is used first to clear the cooling system of any oil or sludge present, and the Clorodine is used to remove rust and scale.

The engine is run slowly for a half-hour, or a little more, while the jacket contains Trisila solution. Then the system is drained and flushed with water and the Clorodine solution is put in, circulated for one or two minutes, allowed to stand for ten minutes, circulated for five minutes, and drained out. (In most cases this solution can be saved for use a second time.) At the end of the process, the jacket is filled with water to which has been added two or three ounces of Trisila, to neutralize any remaining acid. This water may be allowed to remain.

Clorodine finds many other applications, notably in cleaning boilers, auto radiators, cans and bottles, and bottle-washing machinery. In fact, it is good for cleaning any system that accumulates rust or water scale. Clorodine may be used in contact with copper, steel, stainless steel, but is not recommended for use in contact with aluminum.